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ABSTRACT

The purpose of this study was to determine whether the variables found to influence learning in laboratory settings were able to produce effective student achievement when utilized in Venezuelan distance education. Three versions of the same instructional content were employed, and 42 volunteer college students were randomly assigned to three experimental groups. Group 1 received a text in which such instructional aids as objectives, advance organizers, and exercises were interspersed with the reading material; Group 2 received the same content, but the text and aids were separated; and Group 3 received only the text materials. A posttest-only design was employed. It was found that Group 1 performed at a significantly higher level in the posttest than Group 3. Organization, condensation, and content that meets the needs of an adult learner were found to be the factors in the study materials that were most effective for these students. There was also evidence that different versions stimulated different learning activities and that higher achievement was obtained when the instructional aids were taken into account. Although all students obtained the lowest scores on items requiring deep processing, Groups 1 and 2 obtained higher mean scores than Group 3; the deepest levels were attained by subjects who reported that they had applied the study techniques recommended in the instructional material. The text is supplemented by 14 tables, 1 figure, and 80 references. Three appendices provide copies of materials used in the study, and a fourth presents a commentary on the study's methodology by R. Schuemer together with a reply by the author. (Author/EW)

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Anne Benkö de Rotaeche

The Influence of an Instructional Design Upon Learning of Distance Education Students in Venezuela

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THE INFLUENCE OF AN INSTRUCTIONAL DESIGN UPON THE LEARNING OF DISTANCE EDUCATION STUDENTS IN VENEZUELA

ANNE BENKÖ DE ROTAECHE, M.A.

AUGUST 1987

TABLE OF CONTENTS

Page

Introduction (B. Holmberg) v

ABSTRACT vii

Chapter

I INTRODUCTION 1

Context of the Problem. 6
Statement of the Problem. 6
Expectations. 6
Rationale 7
Operational Definition of the Variables 8

Independent Variable 8
Dependent Variable 8
Moderator Variables. 9

Significance of the Study 9

II REVIEW OF THE LITERATURE 10

Introductory Strategies 10

Pretests 10
Objectives 10
Advance Organizers 13

Individual Differences and Advance Organizers . 16

Instructions 16

Instructional Strategies. 18

Organization of the Instructional Material 18
Use of Definitions and Examples. 26
Redundancy 29
Imagery. 29
Interspersed Questions 30

Verbatim Inserted Questions 31
Higher-order Inserted Questions 31

Chapter		Page
	Higher-order Prequestions	31
	Higher-order Postquestions	32
	Higher-order Pre- and Postquestions Compared	33
	Prequestions and Postquestions Compared to No Questions	33
	Inferred Processes Associated with the Use of Adjunct Questions	34
	Individual Differences in Relation to Inserted Questions	35
	Postinstructional Strategies	36
	Feedback	36
	Interaction of Strategies	38
	Learning Objectives and the Organization of Prose	38
	Level of Adjunct Questions, Type of Feedback, and Learning Concepts from Prose	39
III	METHOD	40
	Subjects	40
	Materials	40
	Learning Materials	40
	Additional Comments with Regard to the Learning Material	43
	Posttest	47
	Questionnaire	47
	Procedure	49
	Design	49
	Data Analysis	50
IV	RESULTS	51
	Hypothesis 1	51
	Hypothesis 2	59
	Hypothesis 2.a	59
	Hypothesis 2.b	61
	Hypothesis 2.c	61
	Hypothesis 3	64

Chapter — Page

V DISCUSSION. 67

REFERENCES. 74

APPENDICES. 80

Appendix A: Posttest 81
Appendix B: Questionnaire. 96
Appendix C: Instructions and Information 116

Appendix D: - Some methological remarks on the study 122
(by R. Schuemer)

- The author's reply (Anne Benkö de Rotaeche) . . . 127

LIST OF TABLES

Table		Page
1	Score of Each Student on the Posttest	51
2	Summary of the Analysis of Variance for the Posttest in the Three Groups	52
3	Frequency with which Several Aspects of the Material were Appreciated by the Students.	55
4	Frequency with which Several Aspects of the Material were Criticized by the Students	56
5	Frequency of Comments on Positive Aspects of the Material.	57
6	Frequency of Comments on Negative Aspects of the Material.	58
7	Posttest Means and Standard Deviations of Student Groups Classified According to Two Variables: Treatment Group and Study Behavior.	60
8	Analysis of Variance of Posttest Scores Based on Study Behavior and Treatment Group.	60
9	Posttest Means and Standard Deviations of Student Groups Classified According to Two Variables: Treatment Group and Age	62
10	Analysis of Variance of Posttest Scores Based on Age and Treatment Group	62
11	Posttest Means and Standard Deviations of Student Groups Classified According to Two Variables: Treatment Group and Educational Level	63
12	Analysis of Variance of Posttest Scores Based on Educational Level and Treatment Group	63
13	Posttest Means and Standard Deviations Classified on the Basis of Treatment Group and Level of Processing Required.	65
14	Analysis of Variance of Posttest Scores Based on Processing Level and Treatment Group.	65

LIST OF FIGURES

Figure		Page
1	Interaction Between Treatment Level and Processing	66

INTRODUCTION

Anne Benkö de Rotaeche's study as printed here is of particular interest to distance educators as it looks into the influence of various procedures applied to support learning from written texts.

It is well known to distance educators that techniques have been developed to direct students' attention to important issues, to considering and searching for solutions. Various designs are used to help students to structure their learning. Apart from graphical methods such as headings, graphs, and change of type a number of pedagogical pointers are used. Here belong attention-directors of various kinds. Those which are most typical of distance-study courses are suggestions to note or review something and self-checking exercises. Assignments for submission can also have this function.

Of general interest in this context are Ausubel's 'advance organisers' which

> 'are introduced in advance of the learning material itself and are also presented at a higher level of abstraction, generality, and inclusiveness; and since the substantive content of a given organizer or series of organizers is selected on the basis of their appropriateness for explaining, integrating, and interrelating the material they precede, this strategy simultaneously satisfies the ... criteria ... for enhancing the organizational strength of cognitive structure.'
>
> (Ausubel 1968 p. 148)

Ausubel, who distinguishes advance organisers from summaries or overviews which 'are ordinarily presented at the same level of abstraction ... as the learning material itself' (ibidem), argues in favour of a hierarchical theory of cognitive structure. New learning materials are seen as items which are subsumed unter already existing cognitive structures. Early research on the whole gave proof of the effectiveness of advance organisers, but later studies have produced conflicting evidence as to their effectiveness.

The advance organisers describe the basic concepts of the immediately following part of the course and 'bridge the gap between what the learner already knows and what he needs to know before he can successfully learn the task at hand'. They have proved helpful to students because, 'not only is the new material rendered more familiar and potentially meaningful, but the most relevant ideational antecedents in cognitive structures are also selected and utilized in integrated fashion' (Ausubel 1968 pp. 148 and 137). Advance organisers thus, in Rothkopf's terminology, would seem to promote mathemagenic positive behaviour, that is behaviour that is conducive to individual learning (mathema = learning; gignesthai = be borne).

The use of questions in the text is another procedure applied to structure the learning. Rothkopf initiated a series of studies on the effectiveness of questions placed before the text passages concerned, inserted into them or placed after them. Not unexpectedly it was found that, whereas introductory questions tend to lead the study to what would answer them specifically to the detriment of the study of other parts of the text, those placed after the text passage have a more general effect, stimulate more careful learning and lead to slower learning of later passages. The delaying effect seems to disappear gradually, maybe because better study skills have been acquired with the help of the questions.

Research at the Open University

> 'supports, but so far does not add to, the practice of inserting into texts higher-level (not rote recall) questions after the relevant teaching material. This practice was adopted at the Open University in 1969 on grounds of common-sense, teaching experience and the distilled experience of practical work on programmed instruction'.
>
> (Macdonald-Ross 1979 p. 24)

Anne Benkö de Rotaeche uses Ausubel's and Rothkopf's approaches as starting points for a study of the influence of teaching strategies applied to written material.

Her investigation is based on the study of the effectiveness of three different versions of a course used by the Universidad Nacional Abierta of Venezuela. Although the student sample concerned is small, the study would seem to be of considerable interest.

While the theme studied is highly relevant to distance education and the investigation painstaking and valuable, research of this kind is methodologically tricky. For this reason a comment by Dr. Rudolf Schuemer on the methods applied and possible and the author's reply to this are printed in an appendix.

Our Institute, ZIFF, is grateful to the author for her permission to let us print her study (originally a Pennsylvania State thesis).

B. Holmberg

ABSTRACT

The purpose of this study was to determine whether the variables found to influence learning in laboratory settings were able to produce effective student achievement when utilized in Venezuelan distance education study material. Three versions of the same instructional content were employed. Forty-two volunteer college students were randomly assigned to three experimental groups. Group 1 received an instructionally designed text in which such aids as objectives, advance organisers, and exercises were interspersed along with the reading material. Group 2 received the same content with a different presentation; text materials and instructional aids werde separated into two booklets. Group 3 received the same test materials without any instructional aids. A posttest-only design was employed. Analyses of the results obtained on the posttest indicated that Group 1 performed at a significantly higher level than Group 3. Organization, condensation, and content that meets the interests of an adult learner were the factors in the study materials found to be most effective for these students. No significant effects due to age, study habits, or educational levels were found. There was evidence that different versions stimulated different learning activities and that higher achievements were attained when the instructional aids were taken into account. It was also found that instructional design was able to stimulate a higher level of processing. Although all students obtained the lowest scores on items requiring deep processing, Groups 1 and 2 attained higher mean scores than Group 3; the deepest levels were attained by subjects who reported that they applied the study techniques recommended in the instructional material. This study has implications for the type of instructional materials to be used in Venezuelan distance education.

Chapter I

INTRODUCTION

Context of the Problem

During the last twenty years, the learning and retention processes involved in the study of written materials have attracted a great deal of research. There are probably two reasons for this: one practical and the other theoretical. On the practical side, texts constitute a major medium of learning and are usually used in instructional settings as basic or supportive teaching materials. If we add to this the increasing need of civilized man to keep informed and the vide demand for educational services at all levels, including the burgeoning development of educational innovations for adults such as continuing education, open universities, and distance education, it is easy to understand the interest in developing strategies for writing instructional materials capable of influencing learning and retention.

On the theoretical side, probably the strongest impulse came from the influential work of Ausubel on meaningful verbal learning (1968) and the notion of "mathemagenic behaviors" introduced by Rothkopf (1965). In a period when many psychologists were still studying associative learning, Ausubel pointed out that typically learning in the classroom is qualitatively different from this, and that meaningful verbal learning deserved to be investigated. His emphasis on cognitive processes and structures showed the importance of controlling the presentation of instructional materials and the influence of the knowledge students bring with them to the learning situation. "If I had to reduce all educational psychology to just one principle, I would say this: The most important single factor

influencing learning is what the learner already knows. Ascertain this and teach him accordingly" (Ausubel, 1968). Although Ausubel's work drew attention to meaningful prose learning, it was Rothkopf, according to Faw and Waller (1974), who showed how investigations should be carried out in this field. He suggested that subjects, when studying written materials, not only learn the specific content but also acquire some general facilitative skill, namely "inspection behaviors" which he later called "mathemagenic behaviors" (Rothkopf, 1966). Although criticized for its imprecision (Rickards, 1979), this notion served to "remind researchers that what the student does in the learning situation is an important key to how much he will retain" (Faw & Waller, 1976). Rothkopf created an experimental paradigm which allowed the assessment of a "direct instructive effect" and an "indirect effect," the so-called mathemagenic behavior (Rickards, 1979). Since 1965, research has taken on two orientations: one directed toward the influence of different variables such as the effects of question-answering on text retention, and the other directed toward the processes involved in learning from textual materials. Specifically, in the field of adjunct questions, research influenced by the behavioristic model, originally studied the effects of question frequency and position within prose. Later, influenced by the general trend of experiemntal psychology toward the cognitive model, investigators studied the effects of levels of questions on the depth of the cognitive processes (Rickards & Denner, 1978). As the review of the literature will show, learning is no longer seen as a "mere aggregation of information" but as a "dynamic structure-imposing process,

resulting in schema changes" (Anderson, 1977). In this view, schemata are essentially organizations of information in holistic and hierarchical structures.

Today, a substantial body of knowledge is available on the many variables that may affect learning from prose adjunct pre- and post-questions, advance organizers, text organization, feedback, etc. Generally, the studies have been conducted in laboratory settings. The paradigms used assess the effectiveness of each teaching strategy in isolation, or of a cluster of several strategies, rather than their interrelation within a total learning situation (Hartley & Davies, 1976). The maximum passage length reported for these studies was 23,000 words in the research by Gustafson and Toole (1970).

Many authors (Faw & Waller, 1976; Rickards & Denner, 1978; Rickards, 1979; Gagne, 1978) recommend that future investigations try to keep experimental conditions as close as possible to everyday practical situations. Some of them (for example, Rickards, 1979) also point out that new models are needed to answer relevant questions. In spite of their large number, most of the researchers are decision-oriented and a complete theory of instruction is still lacking (Faw & Waller, 1976).

Based on these conditions, the present study aimed to determine whether the deliberate use of a cluster of teaching strategies in written material could influence learning positively. The setting chosen for this project was not a laboratory, but a real teaching situation. Since instruction is mainly conveyed through written materials in distance education, real studies in a distance university

were used as subjects to test their reactions to real instructional material. The students selected had enrolled in a Venezuelan distance university, the Universidad Nacional Abierta (U.N.A.). This university offers professional degrees in five careers (professions). Its objectives are to develop human resources in national priority areas such as education, engineering, business administration, and mathematics. U.N.A. attempts to cooperate with the higher education system of Venezuela to implement educational innovations and to meet a strong demand for education in the whole country.

Distance education is a mode of education in which instruction is given without any contact between teachers and students. In its origins, distance education used correspondence courses as a means to convey instruction. Today, and specifically at U.N.A., distance education employs an integrated combination of means such as television, radio, audio cassettes, computers, and printed materials. Many countries throughout the world, including the U.S.S.R., France, Australia, Sweden, Japan, and Canada have developed distance procedures for higher education. More recently, new institutions have been created that combine distance education with the principles of open education. These institutions fall into two major groups. Some are more traditional: they offer distance courses, either on their own or in cooperation with other universities (for example, Universidad Autonoma de Mexico, The German Institute of Distance Education at Tubingen University, and The Pennsylvania State University). Venezuela has had twelve years of experience in this type of arrangement at the Universidad Central de Venezuela and some other universities. The

other trend is exemplified by new, self-sufficient institutions, which develop their own courses and confer professional degrees (as is the case of the Open University of Great Britain, Distance Education of Hagen in Germany, the Universidad a Distancia of Spain, Everyman's University of Israel, and U.N.A. in Venezuela) (Universidad Nacional Abierta, 1979).

Distance education is a field of major concern in Latin America since it represents an attempt by several governments to meet an increasing demand for higher education. Examples are the Open Universities of Brazil, Columbia, and Costa Rica. U.N.A. is the largest developing project in the context of distance education in South America.

The material studied in this investigation constituted a complete "unit" of one of the courses which forms part of the curriculum in the field of Education. At U.N.A., a course is divided into "modules" which, in turn, are subdivided into "units." Modules are the principal parts into which the course content is divided; they constitute organized bodies of content and represent the general objectives of the course. Units are the elements of a module. Since this study was focused on a unit, its principal parts will be described. A unit has the following structure: (a) an introductory section, which includes the statement of one or several objectives, general recommendations to the student, one or several advance organizers, and an operational pretest; (b) the main section of the unit, which contains the instructional information, which is an organized body of knowledge including definitions, explanations, examples, pre- and/or postquestions, and

corresponding feedback; (c) a posttest, followed by the correct answers and recommendations to the student ("prescriptions"). As can be seen, the elaboration of a U.N.A. instructional unit follows an "instructional design." In other words, it attempts to incorporate the accumulated knowledge derived from teaching models, learning theories, and experience in distance education.

Statement of the Problem

The purpose of this study was to determine whether: (a) variables found to influence learning in laboratory settings are able to produce effective student achievement in a common teaching unit in Venezuelan distance education, (b) such achievement is related to age, educational background, or study habits, and (c) students are able to use deeper cognitive processes more efficiently as a result of the instructional manipulations.

Expectations

The following expectations were formulated:

1. Three versions of the same written instructional material will result in differential student achievement.
2. Three versions of the same written instructional material will result in differential student achievement depending on age, educational background, and study behavior.
3. Three versions of the same written instructional material will result in differential levels of processing.

Rationale

Studies in laboratory settings have generally demonstrated the effectiveness of several preinstructional strategies (Hartley & Davies, 1976) in student learning. The passages used in these studies were generally short (Faw & Waller, 1976). It seems plausible that these strategies, if deliberately employed as a group, would influence learning positively. It was also to be expected that, as some authors found (Armbruster, 1976), the results obtained using a common instructional unit in artificial settings would be obtained in natural settings.

In addition, since cognitive psychology presumes that the cognitive structure is a network of schemata and the interpretation of particular situations consists of matching elements in the situations with generic characterizations in the schematic knowledge structure (Anderson, Spiro & Anderson, 1978), it could be expected that students having some cultural background -- namely some experience in higher education, recent study in secondary school, or good study habits -- would be more likely to apprehend and learn the concepts of the unit than other kinds of students.

Finally, since Greeno stated that a text which is able to show students the relationship among the parts of a structure is preferable for teaching problem-solving strategies (DiVesta, 1974), since Klausmeier et al. demonstrated that the use of definitions plus examples enhances learning (Armbruster, 1976), and since several authors contend that higher-level questions promote a deeper processing of the instructional material than lower-level questions (Watts &

Anderson, 1979, for example), it would seem that an instructional unit in which a deliberate use was made of such strategies would result in positive transfer to new situations and in deeper cognitive processing than instructional material that does not make use of these strategies.

Operational Definition of the Variables

The principal variables studied in this investigation are operationally defined below.

Independent Variable

In order to test null hypotheses, three versions of the same instructional information were created. The independent variable was the version of the instructional material that was studied by the students.

Dependent Variable

The dependent variable, achievement by the students, was determined by having them respond to a posttest. With regard to the third hypothesis, achievement was studied at three levels. That is to say, the posttest was composed of three levels of questions in order to determine three levels of processing, as follows: (a) Level A -- students would demonstrate mastery of information by being able to recall and make associations between ideas; (b) Level B -- students would demonstrate that they were able to abstract important ideas of concepts, to establish relationships among concepts, to translate communications into other languages, to apply correctly the right procedures to solve a new problem, to analyze, generalize, and

classify properly; and (c) Level C -- students would demonstrate the ability to combine different elements in order to construct a new structure which was not present before, and would demonstrate their ability to write a unique synthesis of ideas.

Moderator Variables

Hypothesis 2 took into account moderator variables which could affect the results. The moderator variables considered in this study were the following: (a) age (defined as 20 to 30 years old, and 30 years of age and above); (b) educational background (defined as completion of high school, technical studies, higher education); and (c) study habits (defined as activities engaged in during the study of the instructional materials, such as rereading of main parts, taking notes, making abstracts, underlining important parts, following the sequence, completing exercises, answering every question, comparing their own answers with those of the instructional material, reading of additional bibliography, seeking counseling).

Significance of the Study

It was hoped that this study would help to identify the extent to which a deliberate manipulation of the presentation of information in an instructional unit would influence the achievement of distance education students. Such information could assist teachers and administrators of distance education in reaching decisions about what kinds of material can best be used to meet the needs of adult students. Therefore, it could be a step toward improving the planning of distance education in Venezuela and other countries.

Chapter II

REVIEW OF THE LITERATURE

In this chapter, the principal experimental findings related to each one of the teaching strategies employed at U.N.A. in its instructional material, including the unit under study, will be summarized. The results of the existing interrelations, and the theoretical explanations postulated will also be reviewed.

Introductory Strategies

Because they are considered to be powerful determinants of motivation, comprehension and retention, introductory strategies are usually chosen and prepared carefully. Each one of their hypothetical functions -- to familiarize the student with the content, to provide a framework in which subsequent learning can be subsumed, to relate what is to be learned to what has already been learned, and to enhance discrimination -- has been studied in experimental contexts. However, as Hartley and Davies (1976) point out, few attempts have been made to compare the practical effectiveness of each strategy.

Pretests

Since no pretest was used in this study, the effects of pretests upon learning will not be reviewed.

Objectives

Objectives are deliberately designed to improve the quality and effectiveness of teaching. Their purpose is to inform students of what they are expected to do after studying some material. As Gagné (1965) argues, objectives facilitate study since they provide a

clear goal that helps students organize learning activities, reduce time wasted on irrelevancies, and offer a basis on which they can objectively assess their own progress. For these reasons, much care must be taken to state objectives as unambiguously as possible, and a whole technology of writing objectives has arisen. Some extreme positions urge that, in writing objectives, intangible goals such as "understanding" and "becoming aware of" should be avoided and replaced by overt goals which can be reliably observed and measured. It has been said (Mager, 1962) that an objective should specify the kind of behavior that the student is expected to perform, the conditions under which such behavior should appear and the criteria which will be used to confirm whether the level of performance is acceptable.

Considerable controversy has emerged as a result of this movement. Many authors and teachers claim that excessive specificity and emphasis on detail, which frequently occur in long lists of specific objectives, may draw attention to irrelevant tasks, at the expense of more general humanistic and intellectual goals. In fact, a course is usually conceived in terms of its main goals which are expressed as general objectives. In order to plan instruction, these general objectives are broken down into specific ones that are intended to direct learning progressively toward mastery of the general objectives. Critics contend that the efforts of the instructional designer to identify those steps and tasks conducive to the final behavior are frequently ineffective because fundamental aspects linked to the main goals of a course, such as attitude formation and the establishment of relationships among parts, are forgotten or obscured by the details.

The experimental findings related to the effectiveness of objectives deserve comprehensive review. For example, when studies that did not show positive effects (Jenkins & Deno, 1971) are analyzed, their negative results may be explained by several uncontrolled factors, such as the use of a nondiscriminatory test, considerable prior knowledge on the part of the subjects in the experimental and control groups, or interference resulting from definitions of the objectives implicit in the organization of the material (Faw & Waller, 1976).

Other studies showed a positive effect of objective-related learning (Rothkopf, 1966; Duchastel & Brown, 1974; Lawson, 1974; Gagné & Rothkopf, 1975), often at the expense of incidental learning (Frase & Krietzberg, 1975; Rothkopf & Billington, 1974; Gagné & Rothkopf, 1975). Duell (1974) concluded that objectives stimulate the learning of only such material as is considered unimportant by the subjects. Student expectations of what will be on a test are influenced by the type of material studied, prior experience with tests, and the type of course presented. In order to be useful and not merely to overlap with text organization, behavioral objectives should include major concepts which are not already indicated in the text. These would provide guides which differ from the orientation provided in the written passage.

The conclusions of the investigations related to the influence of objectives on learning may be summarized in the following manner: (a) specific objectives enhance intentional learning rather than incidental learning; (b) specific objectives exert a greater influence on

intentional learning when they are distributed throughout each section of the text, rather than presented all together; (c) general objectives facilitate incidental learning. Apparently, objectives help students organize material into hierarchical structures and derive implications and applications from the instructional material.

In an attempt to explain how objectives operate upon the cognitive structure, Gagné and Britton (1977) suggested that objectives act upon attention and rehearsal. Objectives placed before a reading passage alter attending and encoding strategies. Objectives provided before review influence rehearsal. Using the ACT associationist model of memory proposed by Anderson, Gagné hypothesized that using postobjectives as a guide to construct self-questions may strengthen the pathways used. Long-term recall should improve when self-questions match posttest questions.

Advance Organizers

According to Ausubel (1960), an advance organizer is an outline of the novel ideas that will follow, presented at a higher level of generality and abstraction than within the text itself. The introduction of the unit used in this study constituted an advance organizer. The strategy of presenting an organizer prior to the instructional material is based upon Ausubel's assumption that meaningful acquisition and retention of ideas are enhanced if some general or inclusive principle, to which the ideas can be related or under which they can be subsumed, is offered before they are described specifically and in detail. In fact, Ausubel postulates that cognitive structure is hierarchically organized in terms in "highly organized concepts

under which are subsumed less inclusive subconcepts and informational data." The availability of appropriate and stable subsumers should enhance the incorporability of new materials. Hence, before introducing unfamiliar academic material, a suitable organizer is provided, depending on the subsuming concept. Ausubel states that, as teaching strategies, integrative organizers are more appropriate to abstract content than informational data. One of the main characteristics of an advance organizer as conceived by this author is that it is "relative," i.e., it depends on the learner and the subject matter. A passage that serves as an advance organizer for one learner may not be needed for another learner. The ideal situation would be to "ascertain what the more common preconceptions of learners are by means of appropriate pretests and then to match suitably tailored organizers with pupils exhibiting corresponding preconceptions" (Ausubel, 1968). When a learner lacks prerequisite subsumers, an "expository organizer" is recommended to provide an explicit background under which to subsume the specific concepts which follow. When the learner has the prerequisite subsumer, a "comparative organizer" seems to be useful to emphasize the relation between the existing subsumer and the information which follows it. However, as Mayer (1979) pointed out, "further research is needed to determine the best analogies, images, examples, etc., that serve as effective advance organizers for individual subject matters and learners."

Recently, considerable controversy was aroused by a review of the literature on advance organizers by Barnes and Clawson (1975). After reviewing 32 studies, of which two failed to produce significant

results, they concluded that "advance organizers, as presently constructed, do not facilitate learning." In his defense of advance organizers, Ausubel (1978) outlined several methodological misconceptions that explain these adverse conclusions. He cited several studies of conceptual adjunct prequestions (Rickards & DiVesta, 1974; Rickards & Hatcher, 1975) that "indicate that once the rote learning methodological bias of Rothkopf and Frase (requiring verbatim recall of single text phrases) is discarded in favor of substantive learning of entire paragraphs, . . . superordinate concepts in the adjunct questions facilitate the learning of subordinate textual material in much the same way as advance organizers do." He also referred to a study by Lawton and Wanska (1977) that demonstrated an accelerating and facilitating effect of advance organizers in 6- and 10-year-old children.

Mayer (1979) demonstrated the effectiveness of advance organizers in facilitating far transfer problems and recall, compensating for text organization, assisting discovery learning, facilitating the acquisition of higher-order rules, and linear reasoning. He suggested that high-ability subjects do not need advance organizers, and that low-ability subjects are more likely to benefit from them since they offer a framework that would not otherwise be available.

Mayer proposed an assimilation encoding theory to explain the effects of advance organizers. It is a three-stage model. In the first stage, the information is received by the working memory from the outside world. The second stage corresponds to what is anchored in long-term memory; it refers to available knowledge. The third

stage constitutes the transfer of the anchored knowledge from long-term memory to working memory, and the integration of that knowledge with incoming information during learning. Each stage includes (a) an encoding process which is an active integration of new information with existing knowledge; and (b) a learning outcome which varies as much in amount of information as in breadth. This theory postulates that giving the organizer before learning may result in the activation of available prior knowledge and encoding processes which, in turn, results in a "broader learning outcome."

Individual Differences and Advance Organizers

Smith and Hesse (1969) observed that advance organizers may have different effects upon readers of high and low ability. They found that organizers have negative effects on comprehension with good readers, but positive effects for poor readers. Smith and Hesse concluded that good readers have their own organizational styles which may conflict with the text organization, while poor readers do not have organizational strategies and, consequently, benefit from advance organizers.

Instructions

Because it is assumed that student activity aids learning, some guidelines are generally given prior to presenting written instructional materials. Any of the following recommendations may be given: rereading, underlining, outlining, note-taking, diagraming, and responding to inserted questions.

The empirical evidence as to the teaching effects of these activities is still confused. No significant differences were found among the respective values of rereading, underlining, outlining, and precis writing, in a study by Arnold (1942). With regard to note-taking, several studies showed positive results (Fisher & Harris, 1973; DiVesta & Gray, 1972, 1983; Aiken, Thomas & Shennen, 1975), but other studies showed detrimental effects (Peters, 1972).

Trying to explain these confusing results, Faw and Waller conclude that, as suggested by Weener (1974) and Peters (1972), a good memory may be needed to take advantage of notes. Note-taking may have two beneficial effects on learning. First, it may exert an encoding or organizing function since it involves processing of information. Second, a review of notes at some later time is likely to be helpful. Faw and Waller (1976) noted that the experiments in which the experimental subjects showed a better performance than the control subjects were those in which the rate of presentational material was slow. They hypothesized that note-taking may interfere with attention and the on-going reception of material when presentation rates are fast. In distance education, taking notes may be compared to the experimental situation in which the rate of presentation of the material is very slow, since students learn at their own pace. Nevertheless, what should be taken into account in this type of learning is that there are probably variations in the encoding mechanisms used by students of distance education; some may record notes verbatim, while others elaborate organizational schema. As DiVesta and Gray (1972) assert,

"Investigations on such variations should provide considerable information on the cognitive processes."

Instructional Strategies

Research on the variables that may have significance for learning and retention of prose is relatively recent since one of the major difficulties has been how to operationalize the structure of the material for its use in experiments (Duchastel, 1979). The most important variables studied have been the following: organization of the passage and the relative importance of information within that context, the use of definitions, principles, and examples, the extent to which a passage stimulates imagery, the function of inserted questions of different levels of complexity, and the amount of redundancy.

Organization of the Instructional Material

Studies of the effects of prose organization on the learning process and the amount learned are relatively recent. The main reasons for this are, partly, the belief shared by many investigators that learning processes could be studied most effectively with less complex, more easily controlled stimuli (e.g., lists of nonsense syllables or words) and, partly, the lack, until recently, of reliable procedures for text analysis. Research has now demonstrated that the results obtained from earlier studies with syllables, words, and short sentences cannot be extrapolated to learning from prose, and that the respective results are frequently contradictory (Mayer, 1977). Probably the first attempt to relate the organizational characteristics of a text to cogntive processes was that of Dawes (1966). The main

developments in that field appeared around 1972, when psychologists, like Crothers, Fredericksen, Kintsch, and Meyer, constructed procedures for prose analysis by adapting linguistic procedures, like those of Fillmore, and procedures from the area of artificial intelligence, like those of Simmons, Simmons and Slocum, and Schank (Meyer, 1975).

Most of the texts used at U.N.A. are organized around key concepts that unify or subsume the component ideas. Cognitive psychology assumes that broadly inclusive categories help learners to organize parts of knowledge into their cognitive structures. Specifically, in the framework of schema theory, cognitive structure is a network of "schemata" which are the equivalent of concepts, i.e., "the representation of a category, a general knowledge that incorporates that which is common to a large number of situations or things" (Anderson, Spiro & Anderson, 1978). So, to "interpret a particular situation in terms of a schema, is to match the elements in the situation with the generic characterizations in the schematic knowledge structure . . . Another way to express this is to say that schemata contain slots or placeholders that can be instantiated with certain particular cases" (Anderson, Spiro & Anderson, 1978). Following Kintsch (1977), it may be said that the organization of a text is usually guided by a "schema." In this content, "text schemata are general principles observed by any culture in constructing particular types of texts." In Occidental culture, texts have a propositional base, which represents the essence of the text; when a passage is long, the text material has to be presented as a sequence or hierarchy of subunits.

This organization is called the macrostructure of the text. Each subunit is a limited set of propositions, subordinated to a subject or "label" for that unit, called the "macrostructure proposition." The analysis of a text must then specify how the division into subunits is achieved and how the macroproposition for each unit is derived from the text. Meyer (1977), for example, described a procedure of division which resulted in a tree structure to represent the relationship among the ideas in a text. In order to test the reliability of her procedure, Meyer had two independent judges select the most important ideas in a passage and relate all the component ideas they believed were logically subsumed under the general statement. She obtained an inter-judge agreement of 91.5 percent for her procedure which is still widely used among experimenters.

Studies have also been conducted in order to test the relationship between text organization and cognitive processes. One area of interest has been, for example, the relationship between the importance of ideas in a text and recall. The results point to the fact that important ideas are better recalled. In order to support the ACT model of memory that she adopts, Gagné (1978) compared the studies of Johnson (1970), Meyer (1977), and Kintsch, et al. (1975). Johnson had college students rate idea units on their importance and found that ideas rated as more important were freely recalled with greater probability than less important ideas, on both immediate and long-term tests. However, Meyer and Kintsch et al. found an interaction between importance of the ideas and retention interval, in the sense that increased

retention of superordinate elements was observed immediately after learning and to an even greater extent seven days later.

Although Meyer assumed that these results provided support for the subsumption theory, Gagné considered an alternative interpretation possible in the light of the ACT model of Anderson. This model hypothesizes that: (a) Information is represented in memory by nodes. Important information is represented by a larger number of interconnected nodes. (b) There is a greater probability of recalling important information because a greater number of retrieval cues are attached to it. (c) The greater number of retrieval cues will result in more frequent rehearsal. (d) The result of this frequent rehearsal is that important ideas will be recalled with greater porbability than unimportant ideas at long term. Gagné explained the failure of Johnson to obtain a progressive effect by the fact that his subjects did not know that they were going to retested, and therefore they probably did not rehearse as much as the subjects in the other two experiments.

The field is full of conclusions of this kind in which comparisons are difficult because of the different variables taken into account. The interpretations are also controversial, depending on the theory adopted. Several attempts have been made to clarify why important elements are better recalled. As Pichert (1979) ponts out, this may be related to different strategies operating at the moment of encoding or different strategies operating at retrieval. Among encoding possibilities, two may be mentioned: (a) after identifying important elements, the learner directs a greater amount of attention

and cognitive processing to them; or (b) the learner uses text elements to fill the slots in an existing knowledge net. Material will be better recalled if it fills the available slots. At retrieval, several explanations are also possible: (a) memory search proceeds from generic knowledge to the particular information stored when the text was read; (b) inferential reconstruction takes place. When failing to recall a particular text element, a subject might try to "reconstruct it on the basis of items which usually fill the blank slots in the operative knowledge." Pichert's explanation is consistent with Meyer's position. Their views are important in deciding on teaching strategies, since they emphasize the importance of what the student already knows. This, in turn, takes us back to Ausubel's position that the design of instructional materials should start from an evaluation of what the learner brings to the learning situation.

Attempts have been made in other contexts to demonstrate the hypothesis that reading comprehension, and hence learning, involves filling in specific textual information to abstract schemata. For example, Pearson, Hansen, and Gordon (1979), reasoning that a reader who has a better developed schema for a particular topic should understand and remember more than one with a weaker schema, applied that assumption practically in a natural environment, using second-grade pupils. Children who demonstrated greater prior knowledge showed more comprehension of explicit ideas and of ideas requiring an integration of prior knowledge and text information.

Spiro (1979), working on the selectivity of memory, argued that when reading, we superficially process information, especially when a schema related to the topic already exists. When recall is required,

we just reconstruct on the basis of elements that are topic-related. Meyer (1977) discussed this position as follows: "In non-experimental sutations Sprio would predict that recall of groups of people would not relate to the content structure of a discourse, but instead uniquely to the individuals, as directed by their varying interests and existing knowledge." Meyer accepted this position, but she stated that in typical school situations the learner generally must ascertain the writer's or speaker's message. The reader must have a strategy for dealing with the message and "the most efficient strategy is to utilize the schema or top-level structure of the writer to organize the information for storage in memory." In order to demonstrate this assertion, she cited the Meyer and Freedle study (1979) in which they showed that, when the reader's schemata do not correspond to or are even contrary to those of the author, recall will not necessarily relate to the content structure of the passage. Nevertheless, Anderson et al. (1977) criticized her position in a manner that may be considered somewhat misleading. Specifically, they wrote:

> . . . there is not reason to suppose that it is only when attempting to understand ambiguous passages . . . that subjects bring to bear extra-linguistic knowledge. Indeed, there is every reason to believe that language comprehension always involves using one's knowledge of the world.

This criticism may be misleading since Meyer was arguing about the best strategy for a student to meet the author's -- and hence the teacher's -- criteria, and she described a situation in which this is in fact very difficult because the respective schema are contradictory. Later Anderson et al. (1977), referring to

Wyer's work (1977), underlined the fact that "the implications of new information will be resisted if its acceptance would require a major cognitive reorganization," which looks like a plausible explanation for the same fact noted by Meyer. It is probable, they hypothesized, that people are able to keep materials segregated from logically incompatible beliefs. The implications of such subtle mismatches are very important for the evaluation of a learning process and this is probably why so many taxonomies refer to high-level objectives (application, analysis, synthesis).

The effect of the style used for written materials upon achievement and retention has also been studied. DiVesta (1954) compared three styles (expository, popular, and study guide) in a study applied to correspondence course students. He did not find differences in their relative effectiveness. Nevertheless, and since the experiment is similar to the present one considering the sample and the text used, it is worthwhile noting that "the administrative procedures required in conducting the experiment with correspondence course populations were found to be too ponderous for practical purposes."

The effect of signals or cues in prose has also been studied. For example, Meyer (1977), in a study conducted in 1975, used signaling devices such as statements like: "There are two approaches. One is _____, and the second is _____." She found a tendency for such devices to improve recall, but the effect was not statistically significant. She hypothesized that the smallness of the effect was probably due to the fact that "signaling was aimed primarily at information high in the context structure." As can be seen, there

exists an interrelation between text organization and cues; cues are less effective when the text is hierarchically organized. On the other hand, Glynn and DiVesta (1979) showed that a single set of cues -- instructional or typographical -- increased recall of cue-related propositions, but that two sets of conflicting cues reduced recall. Confirming previously mentioned findings, when no cues were at hand, recall was best for propositions that were considered important by the learners. An important point for text organization is that recall was best when related information was grouped topically. The conclusion of this research was that cueing systems guide prose processing activities. Nevertheless, it is important to relate these results to the observation by Meyer (1977) that "substantial amounts of signaling robbed information from non-signaled information low in the content structure, and subsequently reduced its recall."

The teaching methods used throughout a passage may be based on discovery or on expository techniques. In 1972, Greeno stated that discovery tends to be an effective procedure when the student has relevant prior knowledge. Expository techniques tend to be more effective with students who lack previous information. The first technique is hypothesized to function as a comparative organizer since it is assumed that it helps to incorporate new material into the cognitive structure; the second is supposed to establish subsumers under which new material can be organized, such as an expository advance organizer (DiVesta, 1974). In this context it is worthwhile remembering that, as Greeno stated, a text which is able to show students the relationship among the parts of a structure is recommendable for teaching problem-solving strategies (DiVesta, 1974).

Use of Definitions and Examples

In an overview of studies of concept and principle learning, Armbruster (1976) distinguished between laboratory experiments and experiments conducted under conditions more closely related to educational situations. So many differences between the laboratory and school learning situations have been listed that, following Armbruster, they will be considered irrelevant to the practical purposes of this paper.

With respect to experiments in more natural settings, Armbruster pointed out that the results are contradictory and confusing but could have promising interpretations in the light of schema theory.

As to procedures in concept-teaching, specifically using examples only (without definitions), a study by Swanson (cited by Armbruster) demonstrated that subjects given both positive and negative examples learned the concepts better (with less over- or undergeneralization) than subjects given either only positive, or only negative examples.

Research on the use of both examples and definitions yielded important results for the elaboration of teaching materials. Using the words of Klausmeier et al. (reported by Armbruster): (a) ". . . the number and type of instances presented are less important when a concept definition is provided than when instances alone are used to teach a concept;" (b) "examples used in conjunction with definitions enhance learning;" (c) "a definition plus examples is superior to either condition by itself;" (d) "the relative effectiveness of examples or examples with rules depends on the nature of the expected performance." Coincidentally, in an experiment conducted by Guthrie

(cited by Armbruster) on the learning of rules, the "Rule plus Example" group was superior to all other groups in speed of learning.

In relation to the use of definitions only, a study by Anderson, Kulhavy, and Andre (1972) demonstrated that a high level of learning is possible with definitions alone. But, as Klausmeier et al. observed, "research has not yet provided answers to such educationally important questions as: When introducing a new concept, how much of instruction should rely on verbally presented descriptions and definitions, and how much on presentation of concrete exemplars?" Armbruster claimed that schema theory may have the answer. The learning of a concept may be considered as the acquisition of an appropriate schema in memory. An "appropriate schema" is a network of interrelations bearing the attributes or dimensions of a concept; it bears its own limits, neither too specialized nor too generalized. This definition leads us to a better comprehension of the role of examples in instructional material. Adequate examples would be those that showed the nature and bounds of the variables which constitute a concept. The superiority of learning from definitions and rules can be explained by their providing "information in a structured form most closely resembling the structure of the schema which will be required for its interpretation . . . . It . . . maximizes the likelihood that the interpretation will be appropriate and minimizes the processing required" (Rumelhart & Ortony, 1977). Thus, the requirements for effective examples and definitions are very rigorous; they must communicate an "adequate" schema. What constitutes an adequate schema is probably highly dependent upon the individual characteristics of the learner since it should fit the learner's personal cognitive structure.

> When we turn to a consideration of the retrieval process, the research results become more equivocal. Relative effectiveness of methods is determined by performance on criterion tests. But according to schema theory, supported by the encoding specificity research, the effectiveness of a retrieval cue is a function of the ability of the cue to activate the schema formed on the occasion of the original input. Therefore, performance on a criterion test may not be a measure of the adequacy of schema formation at all, but merely of the similarity between the retrieval cue (test item) and the original input. In the absence of explicit information on the nature of the criterion task and its relation to the learning task in most of the reviewed studies, it is not certain what the dependent variables measure. Unless the criterion task can be shown to measure the content of the supposedly encoded concept schema, the measure obtained is not an index of concept learning. (Rumelhart & Ortony, 1977)

This quotation illustrates very clearly the criteria used in the formulation of many of the questions in the posttest of the present study where verbatim cues were avoided in favor of "translation," "comparison," or "application" responses.

Concerning the learning of responses, Armbruster (1976) presented a procedure for principle analysis following as closely as possible the structure of the schema, and attempted to test the hypothesis that a principle presented in conjunction with a domain statement (such as: "These principles apply to _____ and not to _____.") would produce a higher amount of learning than the presentation of a principle or example alone, or of a principle in conjunction with an example. Her experiment failed to confirm this hypothesis, but the analytical procedure might be a useful tool for educators and researchers. This procedure highlights what to teach and how to evaluate the effectiveness of teaching strategies. For research purposes, it shows a way of operationalizing the dependent and independent variables.

Redundancy

Another hypothesis that has received experimental attention has been the possibility that the repetition of an idea influences the probability of its recall. Kintsch et al. (1975) found that the number of repetitions of word concepts was positively related to the probability of their immediate recall. Consistent with the Glynn and DiVesta study mentioned previously, White and Gagné (1976) reported that two sentences having a linking concept were recalled better than two unrelated sentences. Another way of manipulating redundancy is the use of questions interspersed throughout the passage. Its effectiveness has been demonstrated repeatedly (Rothkopf & Kisbicos, 1967; Rothkopf, 1966; etc.). The differential effects of different kinds of inserted questions will be examined in a later section of this chapter.

The ACT theory explains the influential effects of repetition by the use of old links and the addition of new links to the propositional network. The propositional network is a set of nodes connected by links. The nodes represent ideas and the links represent relationships between those ideas. "The occurrence of occasions for practice of responses through reading should improve long-term retention either by strengthening links or, if the practice context is somewhat different from the initial learning context, by encouraging the formation of new links to the to-be-remembered nodes" (Gagné, 1978).

Imagery

Experimental research has demonstrated that imageable material (concrete words versus abstract words; picture pairs versus corresponding words pairs) is better recalled that nonimageable material.

Paivio (1971) "interpreted these results as indicating that there are two independent systems of long-term storage, one visual and one verbal" (Gagné, 1978). The assumption of two storage systems is hardly discussed by other investigators, however. Anderson, for example, postulated that the facilitative effects of imagery occur because prior experience with pictorial stimuli is "richer than is experience with the symbolic counterpart of a pictorial stimulus" (Gagné, 1978).

Among the few systematic studies of the interactive effects of pictures and text on learning from prose, are the findings of Stromnes and Nyman (1974) that immediate and long-term recall (one year) are enhanced by the combined use of both types of information when compared to the recall of a text without pictures. "Nevertheless, pictures and diagrams to accompany printed materials enhance comprehension, if they are necessary and intrinsically related to the reading passage" (Bransford & Johnson, 1972). It is supposed that pictures exert a positive effect upon reading comprehension and learning when they show relationships, provide a basis for organizing information, and "present abstract concepts and principles at concrete levels of thought" (Singer & Rhodes, 1976).

Interspersed Questions

Since Rothkopf's work, the area of adjunct questions is probably the most developed in the field of learning from prose. As Rickards (1979) pointed out, the research turned from a "variables orientation" to a "processes orientation." In the earlier approach, Rothkopf (1966), for example, demonstrated the effect of adjunct pre- and

postquestions on learning (variable orientation). The question -- first raised by Frase (1967) -- of whether the facilitative effect was attributable to a "forward" influence or a "backward" review influence (process orientation) remained open for further study. Inserted questions may vary in level of complexity; they may be verbatim or meaningful. These two broad categories may be studied according to their position (pre- and postquestions), type, and frequency.

Verbatim Inserted Questions

Rothkopf (1966) studied the effects of factual (verbatim) questions inserted immediately before or immediately after related text segments, and measured their effects on incidental and intentional learning. Experimental groups surpassed control groups in intentional learning. With reference to incidental learning, questions-after were more effective than questions-before; nevertheless, when compared to a control group instructed to read carefully, there were no significant differences. In further research, it was found that prequestions generally reduced the amount of incidental learning of the experimental group relative to that of a no-question control group.

Higher-Order Inserted Questions

The research on this kind of question is of major significance in educational contexts. The effects of questions of different levels were first studied by Frase (1969).

Higher-Order Prequestions. Frase (1969) compared the effects of factual questions with those of inferential questions, the latter aimed at the inference of relations among different sentences in a passage.

Although the inferential group did not demonstrate a clear superiority at drawing new inferences, it retained more information than did the group given verbatim prequestions. It is presumed that inferential prequestions lead to increased attention being given to a greater portion of information than do verbatim prequestions (Rickards & Denner, 1978).

Higher-Order Postquestions. Watts and Anderson (1971) found that postquestions that required the application of concepts or principles resulted in positive transfer in a new application situation. They interpreted this to mean that higher-level postquestions promote a deeper processing of the instructional material than low-level postquestions.

Comparing the effects of rote-learning postquestions and rote-learning of ideas with postquestions of a "meaningful" kind, Rickards and DiVesta (1974) found that: (a) meaningful learning postquestions were more effective than verbatim postquestions; (b) meaningful learning postquestions were more effective when placed more frequently in the text; (c) all question types produced higher intentional learning than no questions at all; (d) meaningful learning postquestions also produced a greater amount of incidental learning than no questions; (e) on a free-recall test, the meaningful learning postquestion group presented better organized ideas than the other groups. It was concluded that such meaningful postquestions required the learners to relate subordinate passage content to general ideas in the text.

It is worth citing one comment with respect to the frequency and position of postquestions, "placing meaningful learning questions relatively far apart may . . . overtax . . . the subject's processing capacity, that is, produce excessive cognitive strain (Bruner et al., 1956), thereby eliminating their advantage over other types of questions" (Rickards & DiVesta, 1974). "Verbatim postquestions, on the other hand, produce very little cognitive strain whether they were placed close together or far apart, since the processing behaviors associated with these question types were less extensive (Rickards & Denner, 1978).

Higher-Order Pre- and Postquestions Compared. A consistent position effect for conceptual questions has not been found. For each study in which the position and level of the adjunct questions were simultaneously varied, different results were obtained. Felker and Dapra (1975) found the effect of conceptual postquestions to be superior to that of conceptual prequestions, while Rickards found the opposite to be true, and Mayer (1975) found no differential effect due to position. Presumably, these differences were in part a consequence of the different kinds of conceptual questions employed by each investigator. Accordingly, it is not yet possible to ascertain "which kinds of conceptual questions are likely to function best as prequestions and which as postquestions" (Rickards & Denner, 1978).

Prequestions and Postquestions Compared to No Questions

Sagaria and DiVesta (1978) tested the hypothesis that the effect of "pre- and postquestions in combination (QBA) would be equivalent

to the combined independent effects of prequestions only (QB) plus postquestions only (QA)." They found that: (a) prequestions enhance selective attention but not selective retention; (b) QBA produces more intentional learning than QB, but not more than QA; (c) in relation to incidental learning, QBA does not benefit more than QA or NoQ; (d) frequent and regular QA tends to increase intentional learning over time at the expense of incidental learning. These last results correspond to Ausubel's statement that "the more the material is broken by questions, the more incidental learning tends to be inhibited; whereas, frequent questions tend to improve retention of relevant (intentional) material" (Sagaria & DiVesta, 1978).

Inferred Processes Associated with the Use of Adjunct Questions

The question raised by Frase about hypothetical backward or forward effects produced by questions inserted in prose has been frequently submitted to experimental research. With the design of different new techniques, several results have been obtained. For example, Mayer (1975), found an enhancement of transfer to new situations and assumed that inserted questions perform a specific forward function. McGraw and Gotelueschen (1972) found both general forward and backward processes associated with a temporary increase in attention to the whole passage. Later, Rickards and DiVesta (1974) found that: (a) factual postquestions alone promoted a specific backward process; (b) postquestions related to rote learning of ideas suggested to them a general backward process (review); (c) the analysis of the results under meaningful learning postquestion conditions tended to indicate a specific forward and backward process.

In conclusion, it seems that adjunct questions control the acquisition of intentional and incidental information differently. As Sagaria and DiVesta stated, prequestions function as discriminatory cues. As compared to a no-questions condition, questions seem to direct attention toward information that would not otherwise be taken into account. When material is poorly organized, inserted questions exert a guiding influence; at the same time, positive feedback provides the information that the strategy adopted is adequate and should be maintained. Sagaria and DiVesta (1978) hypothesized that inserted questions evoke expectancies that determine the selection of specific learning strategies. On the other hand, postquestions enhance the retention of material attended to in the encoding process. Although the joint action of both pre- and postquestions does not result in better learning of incidental information as compared to postquestions or no questions at all, it does enhance the selective retention of intentional material.

Individual Differences in Relation to Inserted Questions

An important finding for distance education is that experimental research has show that subjects with low verbal capacity benefit more from higher-order postquestions than subjects with high verbal capacity who achieved about equally under question and no-question conditions (Shavelson et al., 1974). Rickards and Hatcher (1978), applying meaningful learning questions, rote-learning questions, and no questions to fifth-grade children, found that poor comprehenders showed significantly higher recall with the first condition. They

concluded that the higher-level postquestions may not benefit good comprehenders as much as poor comprehenders because good comprehenders probably generate a context spontaneously while reading.

It is worthwhile citing the observation by Gustafson and Toole (1970) that in normal homework assignments inserted questions may not have a general facilitative effect. Hiller (1974) tested the hypothesis that, in home study, students may have time to read and reread the material. His study confirmed this hypothesis and also found that students tend to study only the inserted questions related to the material at hand but not the text as a whole.

Postinstructional Strategies

Learning from text is influenced by events that occur after the learner has studied the text material. Primary among these events is feedback.

Feedback

Feedback consists in "any of the numerous procedures that are used to tell a learner if an instructional response is right or wrong" (Kulhavy, 1977). It ranges from the simplest "Yes-No" form to the presentation of substantial information which may extent the content of the instructional material or even add new information to it. This latter form goes beyond simply informing about correctness.

Numerous studies have been conducted in order to show the effects of feedback on learning. The results are sometimes positive and sometimes negative. Kulhavy, trying to explain these contradictory

results, revised the material and procedures used in these experiments. He identified two negative conditions under which feedback fails to perform its facilitative function. One is that if text formats permit learners to see the feedback before responding, copying is likely to result and students learn little because they write without searching through or even reading the text. In other words, they bypass most of the instruction (Anderson & Faust, 1967). This finding can be related to those of Gustafson and Toole (1970) and Hiller (1974), cited above in relation to adjunct questions in a text. Second, when the material studied is very difficult for the learners, they spend most of their time guessing at answers and then trying to associate the feedback with the question. Feedback performs its correcting function effectively only if mistakes result from faulty interpretation, not from lack of understanding. If learners fail to comprehend the material, feedback has no more than cursory effect on performance.

Once decremental factors like answer availability and low comprehension are accounted for, feedback performs two functions. It confirms right answers, and it identifies and allows the learner to correct wrong ones. Feedback following wrong responses has the greatest positive effect. When learners have high response confidence and the response chosen is wrong, they are likely to spend a considerable amount of time in trying to locate the source of their mistake. When response confidence is low, feedback has a minimal effect, regardless of whether the answer is correct or not, since students with poor comprehension are likely to use associative strategies rather than the integration of new information into an existing structure.

Kulhavy insisted that there is a powerful interaction between a learner's expectation and feedback. This interaction affects what the learner will remember from a text. Based on this finding, Kulhavy postulated that feedback and its form of presentation can be manipulated more effectively if they are in some way made contingent on learner expectation. For instructional design, his principal recommendations were the following. "First, make sure that learners have appropriate entry skills for the lesson; second, structure the material in such a fashion that the response precedes the feedback, in spite of the student. Finally, provide feedback as often as possible during the course of the lesson" (Kulhavy, 1977).

Interaction of Strategies

A number of studies have examined the effects of the strategies described above in interaction with one another.

Learning Objectives and the Organization of Prose

Rothkopf and his associates studied the interaction of objectives with both the density of the information in a text (Rothkopf & Kaplan, 1972) and with the degree of dispersion of the information in a text (Gagné & Rothkopf, 1975).

Duell (1974) reached the conclusion that the importance attributed to a text element determines whether or not objectives will facilitate learning. If learners consider an element to be important, they will learn it, whether or not it is related to an objective; with an element judged less important, learners will be influenced by the presence or

absence of an objective related to it. Melton (1978) came to a similar conclusion conducting a study in a natural setting.

Duchastel (1979) investigated how the structure of the text interacts with objectives on learning. There were no joint effects of structure and objectives. This implies that the provision of the two forms of orientation add little to the provision of either one of them alone. Like previous researchers (Duell, 1974; Melton, 1978), Duchastell concluded that objectives are more likely to affect learning positively if they relate to material which is judged to be unimportant by the learners.

Level of Adjunct Questions, Type of Feedback, and Learning Concepts from Prose

The effects of level of questioning (factual questions or application questions) and the type of feedback on learning of concepts from prose were examined in a study of undergraduate students (Singer & Rhodes, 1976). Adjunct application questions produced better performance on subsequent new application items. This result supported the conclusion that practicing application while studying facilitates later use of concepts. Feedback influenced performance on the questions asked during the instruction, but not on new factual or application questions. These results underline the value of what students do during learning and the importance of their use of feedback.

Chapter III

Method

Subjects

The subjects in this study were 42 volunteer college students enrolled in the Education Department of the Universidad Nacional Abierta (U.N.A.) in Caracas. They were candidates for admission to the program in Learning Disabilities which was scheduled to begin for them six months later. They therefore were not acquainted with the material they would be exposed to in this study (as was confirmed by their answers to the questionnaire which will be described below).

Materials

Three kinds of materials were used in this study:

- learning materials
- a posttest
- a questionnaire

Learning Materials

The material selected for this study was one "unit" from an introductory course on Learning Disabilities (Course: "Dificultades de Aprendizaje I"). The content of this material was mainly a definition of learning disabilities and the functions performed by professionals in this area. Three versions of this material were prepared: 1. Interspersed; 2. Separated (segregated); 3. Eliminated (removed).

1. The Interspersed Version was a copy of a "unit" taken from a text which is presently being used as instructional material at U.N.A. As mentioned in the first chapter, this material was divided into three sections: introduction, instruction, and postinstruction.

The introductory section, which functioned as an advance organizer, included:

(a) a table of contents,

(b) an explanation of the task the student was exepcted to perform,

(c) a general introduction to the field of learning disabilities.

The instructional section included:

(a) an introduction to the unit (advance organizer),

(b) the text itself, including definitions and examples,

(c) exercises (interspersed postquestions plus feedback).

The postinstructional section consisted of:

(a) a list of the general and specific objectives of the unit,

(b) a self-evaluation,

(c) feedback (acceptable answers and additional explanations).

The actual U.N.A. text also contains a list of reference books and articles, but this was removed in order to find out -- by means of the questionnaire -- if the students were interested in looking for additional information after studying the unit.

The length of the unit was 52 pages (approximately 13,420 words) divided as follows:

Introductory section . . . . . 8 pages

Instructional section. . . . . .35 pages

Title . . . . . 1 page

Introduction. . . . . 1 page

Instructional text. . . . . .18 pages

Exercises . . . . . .15 pages

Postinstructional section. . . . . 9 pages

The content of the unit was designed and written by a U.N.A. professor on the basis of current information about the field. Underlying the development of the material were several objectives -- one general and six specific -- which appeared at the beginning of the postinstructional section.

2. The Separated (or segrated) Version was presented in two booklets. The first (Selected Readings) conveyed the instructional information. This was 44 pages long (approximately 11,968 words). This material corresponded in content to the "instructional text" of the first version. This text was not written by U.N.A. teachers, but was taken from several standard works in the field of learning disabilities. The readings were selected in order to cover the same subject matter as the respective section of the first version. They were presented in logical sequence in the booklet.

The second booklet, the Study Guide, contained all of the instructional "aids." These aids were exactly the same as those contained in the first version. In other words, the following elements were segregated from the first version and placed in this booklet:

- introductory section,
- exercises (questions plus feedback),
- postinstructional section (objectives, self-evaluation, and answers).

3. The Eliminated (or removed) Version had the same content as the first booklet (Selected Readings) of the second version. All of the instructional "aids" were totally eliminated, however. That is to say, the information was given in 44 pages (approximately 11,968 words).

Additional Comments with Regard to the Learning Material

Each of the versions contained several distinctive features: The Interspersed Version, for example, was organized as described below:

1. Introductory section: No objectives were presented at the beginning of the unit since it was argued that incidental learning should be encouraged rather than hindered. It was also argued that this important aim would be furthered by inserting some essay questions into the text. These were intended to stimulate active comparisions, inferences, and the derivation of social or educational implications. It was also thought that a long list of operational objectives would overwhelm the student and reduce motivation. In addition it was believed that if too many objectives were specified, a number would not be read with comprehension by the students and they would therefore not fulfill their intended purpose.

However, as mentioned before, one general and six specific objectives were written in order to develop the instructional

design, the self-evaluation, and the posttest. This explicit list was included at the end of the instructional material, as an introduction or guide for the self-evaluation. The intention was to provide the students with a basis for review and to offer them an organizational framework for that purpose. In this sense, the specific objectives had a teaching purpose, i.e., placed at the end of the instructional material, they should influence rehearsal and produce long-term effects. Therefore, such objectives were assumed to function more as inserted questions than as objectives.

With regard to the general information and the introduction to the unit, used as advance organizers, they were written in a very general manner, in an attempt to establish the relationship of the unit to the area of learning disabilities as a whole.

In the presentation of the study -- which appeared at the beginning of the unit -- emphasis was placed on time scheduling and on the fact that students should participate as actively as possible in the learning process. They were asked to respond to all of the interspersed questions, to follow the explanations and examples, to take notes, to make summaries, or whatever symbolic representations would help them understand and review the material.

2. Instructional section: This section was organized around main topics (general titles) which were in turn subdivided into component sections (subtitles). Also, as mentioned before, there was a table of contents to help students grasp the organization of the unit.

The style of this version was expository, and an effort was made to establish a personal relationship with the student. Special care was taken to define each new concept and offer at least one example. The sequence of the presentation varied (definition plus example, or examples plus definition, or a definition followed by an exercise which was intended to serve as an example, etc.) in order to avoid monotony in style. The main ideas were generally placed at the beginning or end of each paragraph; the remaining sentences usually were lower-level clarifications. There was a deliberate attempt to select examples based on the frequency with which problems are encountered in the field of education in Venezuela.

The exercises contained in the instructional section had several purposes, depending on where they were inserted. The main aims were to review or redefine concepts, to infer interrelationships, and to suggest implications. Since the course was an introductory one, the emphasis was on concepts and their clear demarcation. The nature of the questions varied in order to introduce novelty and encourage different levels of processing. Some questions were multiple-choice, others were completion, others were short essay questions, and so on. Sometimes, mapping or summarizing was requested.

Feedback was offered immediately after questioning, frequently accompanied by explanations which attempted to complement the information in the instructional body of text. When free answers were requested, the feedback gave a general outline of the points that it would have been advisable to include and developed some arguments when reasoning was requested.

3. The postinstructional section presented a list of objectives and a self-evaluation. The self-evaluation aimed at an overview of the principal aspects of the unit. It emphasized the main concepts and relationships. It was constructed following a table of specifications, based on three levels of Bloom's taxonomy: information, comprehension-application, and synthesis. This approach, as mentioned in the first chapter, tends to correspond to DiVesta's view of the learning process (DiVesta, 1972). The test consisted of 33 simple-choice items. Feedback following the self-evaluation was also given in an expository form when special explanations were needed. In that sense, feedback was thought of as a teaching device and added new information to the text.

The distinctive features of the Separated Version were as described below.

1. The Selected Readings of the first booklet were a series of several fragments (quotations from books and articles) which were part of the current literature in the field of learning disabilities. The language used in this material was very different from the language used in U.N.A.'s instructional units where a deliberate attempt was made to use simple words and examples for each technical term. In spite of the logical sequence in which the text excerpts were placed in the booklet, what was missing was an internal organization based on an instructional design clarifying the content at an introductory level. Nevertheless, a positive aspect of this material was that the information was given directly from its sources, that is, from specialists in the field, and not through the language of a teacher.

2. The Study Guide contained all of the instructional directions telling the student when to read and when to do the exercises. It attempted to give the information gradually (as in the Interspersed Version) and to establish some kind of personal relationship with the student using the pronoun "you" and referring to the current situation in the country whenever possible. As stated before, the content of this booklet was exactly the same as that of the "instructional aids" of the Interspersed Version, but printed separately.

The Eliminated Version consisted of only one booklet: the same Selected Readings used for the Separated Version. In other words, this version contained the same information as the other two versions, but all instructional aid was removed.

Posttest

One posttest was developed for the measurement of the dependent variable. It was constructed following a specifications table, based on the three levels defined in Chapter One. The same posttest was administered to all students, no matter what version of the instructional material they studied. Appendix A contains the Table of Specifications (with special reference to levels A, B, and C), the Posttest, and the Answer Key.

Questionnaire

A questionnaire (Appendix B) was administered at the end of the study in order to clarify such variables as:

- educational background of the student
- age of the student
- professional experience of the student
- time scheduling
- study behavior with the instructional material
- incentives that were used to encourage study
- use of objectives, advance organizers, instructions, examples, inserted questions and feedback, self-evaluation, and feedback
- the perceived usefulness and clarity of the different parts of the material
- interest in looking for additional information on the topic.

Procedure

The study actually started with 120 volunteers, to whom the purpose of the study was explained. After having agreed to participate, they were randomly assigned the study material. Thus, three groups were formed:

Group 1. . . . . received the Interspersed Version

Group 2. . . . . received the Separated Version

Group 3. . . . . received the Eliminated Version

When the posttest was administered, only 42 subjects returned (35 percent of the original sample). Each group was represented by 14 subjects. The remaining subjects were called by phone, but it was impossible to get them to participate further. The data that were analyzed referred to the 42 subjects who took the posttest and filled out the questionnaire.

To understand the study and the cooperation expected of them, the students received a general explanation in Spanish (see Appendix C.1) which said in part:

> Since the Universidad Nacional Abierta is a new national project created as an attempt to improve the quality and quantity of higher education in Venezuela, the University needs to conduct experiments in the field of education in order to identify the best strategies for teaching and learning. You have been selected at random to participate in one of the studies we are conducting. The purpose of this study is to determine the best presentation for our courses. We have prepared instructional material for you. You will study it at home, as best you can, and will come back with all your materials next _____. You will then receive further instructions.

3. Two weeks after receipt of the material, the students were all assembled on the same day in three classrooms. They received some general information (see Appendix C.2) as an introduction to the session. Afterwards, they were administered the questionnaire (a different version for each group, since the questions all related to the instructional material and this differed from one group to the next). After completion of the questionnaire, each student was administered the posttest (the same for the three groups). At the end of the session, each student underwent a short interview with the researcher in order to express his feelings about the study.

Design

A posttest-only design with three groups was employed in this study. In order to avoid any facilitative effect, especially in Group 3, no posttest was used. For each group, the design was the following:

Group 1 . . . . . R X_1 O_1

Group 2 . . . . . R X_2 O_2

Group 3 . . . . . R X_3 O_3

Data Analysis

For hypothesis 1, an analysis of variance was employed to test the relationship between treatment and achievement.

In order to better interpret the results of the analysis of variance, the answers of the students to the questionnaire were analyzed. Several chi-square tests were used to find out whether there existed any relationship between the variables studied in the questionnaire and achievement. Three variables appeared to be important: study behavior, age, and educational background.

For hypothesis 2, in which the purpose was to relate treatment to study behavior, age, and educational background, three separate unweighted means analyses of variance were applied. This technique was selected because of the unequal number of subjects appearing in each cell.

For hypothesis 3, because the same subjects were measured at the three levels, a two-factor ANOVA with repeated measures on one-factor was employed.

Chapter IV

RESULTS

Hypothesis 1

Stated in null terms the first hypothesis is as follows:

Three versions of the same instructional written material will result in equal student achievement.

The total score on the posttest obtained by each student in each experimental group is shown in Table 1, along with the group mean and standard deviation.

TABLE 1

SCORE OF EACH STUDENT

ON THE POSTTEST

Group 1 (Interspersed Version) (N = 14)	Group 2 (Separated Version) (N = 14)	Group 3 (Eliminated Version) (N = 14)
33.0	29.5	18.0
31.5	26.0	17.0
31.5	21.0	16.0
27.0	19.0	16.0
24.5	19.0	15.5
18.5	16.0	13.5
18.0	15.0	12.5
17.5	14.5	12.5
15.0	14.0	12.0
11.5	14.0	9.5
9.0	11.5	9.5
8.5	11.5	9.0
8.5	10.5	7.5
8.5	8.5	6.5
MEAN 18.75	16.43	12.50
STANDARD DEVIATION 8.89	5.74	3.55

To test the first hypothesis, the data were analyzed using a one-way analysis of variance. A summary of the results is given in Table 2. The F-value for treatment (versions) is 3.2 ($p = .0539$). Although an F-value of 3.24 or larger is required for the mean differences to be significant at the .05 level., the obtained F-value is so close to the critical value that the first hypothesis was rejected. It was concluded that student achievement was not the same under the three conditions of study.

TABLE 2

SUMMARY OF THE ANALYSIS OF VARIANCE FOR THE POSTTEST IN THE THREE GROUPS

Source of Variance	df	ss	ms	F	p
Between groups	2	279.47	139.73	3.12	.06
Within groups	39	1745.80	44.76		

In order to determine where the difference in achievement actually occurred, a Sheffe test was applied. The critical value for the difference to be significant at the .05 level on the Scheffe test was 5.71. Comparing M_1 and M_2, M_2 and M_3, and M_1 and M_3, a significant difference (6.25) was found between groups 1 and 3 in achievement. Although it is not statistically significant, the difference between M_2 and M_3 (3.93) was higher than the difference between M_1 and M_2 (2.32).

To better interpret these results, the responses of each student to the questionnaire were examined. First, what the students did during the learning process was studied. Using chi-square tests, the three groups were compared on the basis of number of study sessions, time spent in studying, frequency of review, and frequency of consultation with other persons or use of bibliography. No relationships were found between these variables and the version under study. Nevertheless, when the groups were compared on the basis of "study behavior" (item 11.1, 11.2, 11.3, 11.4, 11.5, and 11.12 of the questionnaire) a tendency to exhibit this type of behavior to a greater extent appeared in group 1 than in the other groups ($p < .05$). When groups 1 and 2 were compared regarding the frequency with which they carried out the exercises (items 11.6 and 11.7 of the questionnaire), significant values were found ($\chi^2 = 8.90$, df. 2, $p < .02$), indicating that group 1 was more active in this respect.

Student opinions about what helped them most in their study (items 16.1.1.1 to 16.1.1.11 of the questionnaire) were also analyzed. A significant difference appeared between groups 1 and 2, showing that group 1 considered that all of the instructional aids (items 16.1.1.9 and 16.1.1.10) has been of much help in their learning, except for the illustrations and the additional comments. Group 2 had more frequent answers under "Somewhat" (the instructional aids had "helped somewhat" in their learning). In the questions that were also shared by group 3 (items 16.1.1.3, 16.1.1.4, 16.1.1.8, and 16.1.1.11: organization of the text, explanations inserted in the text, style of the text, and "all of the above"), Group 3 showed a tendency similar

to that of group 1, that is, a tendency to indicate that these instructional characteristics had been of much help in their learning (the level of significance for item 16.1.1.8, for example, was $p < .01$).

Questions 20 and 21 of the questionnaire were open-ended questions directed toward the incentives that were used by the study to keep studying the material and the student's feeling toward the material and the field of learning disabilities. The answers given by the three groups, in terms of frequency, are given in Table 3.

The aspects that were criticized by the students also varied between groups, as shown in Table 4.

Table 5 summarizes the answers of the students to the first part of item 30 of the questionnaire: positive aspects of the material. This question was placed in the questionnaire in order to compare the answers to those given to questions 20 and 21 that were worded in terms of the feelings of the learner (pleasant-unpleasant). Question 30 was worded in more objective terms: what was negative in the material?

Table 6 summarizes the answers of the students to the second part of item 30 of the questionnaire which referred to the negative aspects they found in the instructional material. This question has the aim of checking the answers to question 21, and it was expected that the responses would show a similar tendency as question 21. In fact, it added some new information in the same direction.

TABLE 3

FREQUENCY WITH WHICH SEVERAL ASPECTS OF THE MATERIAL WERE APPRECIATED BY THE STUDENTS

(Based on Questionnaire Item 20)

	ASPECTS															
GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Group 1		2	2	1	2	2	2		2	1	1	2				
Group 2	1				2		2	1	3	2						
Group 3									2	2			2	2	2	

Aspect 1: The material gives me hope that I will be useful to society

Aspect 2: The material uses different approaches

Aspect 3: The material is absorbing (very interesting)

Aspect 4: Examples are given at each level of information

Aspect 5: The material is not tiring or boring

Aspect 6: The material shows the relationship to experience

Aspect 7: The material provides counseling about my career

Aspect 8: This is a dynamic way of helping the student to improve

Aspect 9: The wording is pleasant

Aspect 10: The material is simple and clear

Aspect 11: The material shows the importance of diagnosing and planning

Aspect 12: The material shows cases and motives

Aspect 13: The material introduces one to research

Aspect 14: The material explains how to manage children

Aspect 15: The material gives information on the nervous system and learning

Aspect 16: All the material

TABLE 4

FREQUENCY WITH WHICH SEVERAL ASPECTS OF THE MATERIAL WERE CRITICIZED BY THE STUDENTS

(Based on Questionnaire Item 21)

	ASPECTS						
GROUP	1	2	3	4	5	6	7
Group 1	3	1		1	1		
Group 2	4	2	1		1		
Group 3	4					2	2

Aspect 1: Some aspects of the material disliked, but not described specifically

Aspect 2: The material was a photocopy

Aspect 3: The kind of printing

Aspect 4: Position of the objectives

Aspect 5: Lack of the use of color in the material

Aspect 6: Too many references and citations

Aspect 7: Specialized vocabulary

TABLE 5

FREQUECNY OF COMMENTS ON POSITIVE ASPECTS OF THE MATERIAL

(Based on Questionnaire Item 30)

	ASPECTS																							
GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Group 1	6	6	4	1	1	1	2	3	3	1	4	5	3	3	3									3
Group 2	2	2		2				2				2	2	2	2	2								2
Group 3	5		5	2			1	3					2	1	4						3	2	4	

Aspect 1: Pleasant and simple wording
Aspect 2: Quality of the exercises
Aspect 3: It stimulates the desire to study
Aspect 4: It gives information about special education
Aspect 5: The comparison between different approaches (the way they are compared)
Aspect 6: Complementary notes (final section of the instructional material)
Aspect 7: Role of the specialist (or teacher) in learning disabilities
Aspect 8: Organization of the material
Aspect 9: Self-evaluation
Aspect 10: The scienctific approach
Aspect 11: Preciseness
Aspect 12: Abundant exercises
Aspect 13: Interesting information, clearly explained
Aspect 14: Orientation about my career
Aspect 15: Examples
Aspect 16: Short in length
Aspect 17: Selected Readings
Aspect 18: Final synthesis
Aspect 19: Figures (they are helpful for the explanations)
Aspect 20: Study Guide (it allows review and self-correction)
Aspect 21: Brings awareness about these problems and education
Aspect 22: Easy to study
Aspect 23: Clarifies doubts
Aspect 24: Provides basic concepts

TABLE 6

FREQUECNY OF COMMENTS ON NEGATIVE ASPECTS OF THE MATERIAL

(Based on Questionnaire Item 30)

	ASPECTS																	
GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Group 1	1	3	4	2	5	1	1	1										
Group 2					1	1										1	1	1
Group 3			1			4			1	4	1	1	1	1	1	1		

Aspect 1: Place on the objectives (at the end)

Aspect 2: It is a photocopy

Aspect 3: Lack of illustrations

Aspect 4: Letter print

Aspect 5: Lack of references

Asepct 6: Vocabulary too technical

Aspect 7: Lack of the use of color in the material

Aspect 8: Repetitive

Aspect 9: The original texts are in English

Aspect 10: Too many citations

Aspect 11: Too short

Aspect 12: Too general

Aspect 13: Confusing

Aspect 14: Lack of a summary at the end

Aspect 15: Lack of self-evaluation

Aspect 16: Lack of a glossary

Aspect 17: Two booklets (one would be better)

Aspect 18: Selected Readings, difficult

Hypothesis 2

Stated in null terms, hypothesis 2 is as follows:

> Three versions of the same instructional written material results in equal student achievement regardless of: (a) study behavior, (b) age, and (c) educational background.

Hypothesis 2.a

Applied specifically to the study behavior of the student, hypothesis 2 may be stated as follows:

> Three versions of the same instructional written material results in equal student achievement regardless of study behavior.

Study behavior implies doing items 11.1, 11.2, 11.3, 11.4, 11.5, and 11.12 of the questionnaire, "frequently," sometimes," or "never." In other words, it is based on the frequency with which students report that they reread principal parts, take notes, make diagrams, and follow the indicated sequence. Table 7 shows the means and standard deviations of study scores on the posttest, based on behavior and treatment group.

An analysis of variance was applied to these data; since the cells had different numbers of subjects, an unweighted means analysis was employed. Table 8 shows the summary of the results of this analysis.

The F-ratios for study behavior and the study behavior by treatment group interaction are not statistically significant. Therefore, the null hypothesis is retained. There is no significant difference in student achievement due to study behavior and there is no evidence of an interaction effect between study behavior and treatment.

TABLE 7

POSTTEST MEANS AND STANDARD DEVIATIONS OF STUDENT GROUPS CLASSIFIED ACCORDING TO TWO VARIABLES: TREATMENT GROUP AND STUDY BEHAVIOR

Study Behavior Responses		Treatment Group 1 Interspersed Version	2 Separated Version	3 Eliminated Version	All Groups
Mostly "Frequently"	Mean	21.33	16.50	7.83	17.67
	S.D.	10.46	2.29	1.53	9.65
Mostly "Sometimes"	Mean	13.12	20.20	14.00	15.62
	S.D.	3.94	7.49	2.56	5.41
Mostly "Never"	Mean	18.00	13.24	13.17	13.70
	S.D.	0.00	4.34	4.54	4.16

TABLE 8

ANALYSIS OF VARIANCE OF POSTTEST SCORES BASED ON STUDY BEHAVIOR AND TREATMENT GORUP

(Unweighted Means Analysis)

Source of Variation	df	ss	ms	F	p
Study Behavior (A)	2	4.477	2.238	0.055	
Treatment Group)B)	2	187.392	43.696	2.304	.114
A X B	4	249.986	62.496	1.537	.213
Within Cells (Error)	33	1342.196	40.673		

Hypothesis 2.b

Applied specifically to the age of the student, hypothesis 2 may be stated as follows:

> Three versions of the same instructional written material results in equal student achievement regardless of age.

Students were assigned to two age groups; the means and standard deviations of student scores, based on age and treatment group, appear in Table 9. The analysis of variance of these data, based on an unweighted means analysis, is summarized in Table 10.

The F-ratios for age and the age by treatment group interaction are not statistically significant. Therefore, the null hypothesis is retained. There is no significant difference in study achievement based on age and there is no evidence of an age by treatment interaction.

Hypothesis 2.c

Applied specifically to the educational background of the students, hypothesis 2 may be stated as follows:

> Three versions of the same instructional written material results in equal student achievement regardless of educational background.

The mean and standard deviations of the student scores, based on educational level attained and treatment group, are presented in Table 11.

An unweighted means analysis was applied to these data. Table 12 presents the summary of the results of this analysis.

The F-ratios for educational level and the educational level by treatment group interaction are not statistically significant.

TABLE 9

POSTTEST MEANS AND STANDARD DEVIATIONS OF STUDENT GROUPS CLASSIFIED ACCORDING TO TWO VARIABLES: TREATMENT GROUP AND AGE

Age Group (in years)		Treatment Group 1 Interspersed Version	2 Separated Version	3 Eliminated Version	All Groups
20 to 30	Mean	17.69	17.58	13.14	15.89
	S.D.	13.17	5.94	3.18	6.89
30 and above	Mean	20.17	15.56	11.30	15.89
	S.D.	9.05	6.22	4.59	7.38

TABLE 10

ANALYSIS OF VARIANCE OF POSTTEST SCORES BASED ON AGE AND TREATMENT GROUP

(Unweighted Means Analysis)

Source of Variation	df	ss	ms	F	p
Age (A)	1	2.214	2.217	.047	
Treatment Group (B)	2	309.378	154.689	3.277	.048
A X B	2	43.781	21.891	.464	
Within Cells (Error)	36	1699.529	47.209		

TABLE 11

POSTTEST MEANS AND STANDARD DEVIATIONS OF STUDENT GROUPS CLASSIFIED ACCORDING TO TWO VARIABLES: TREATMENT GROUP AND EDUCATIONAL LEVEL

Educational Level		Treatment Group 1 Interspersed	2 Separated	3 Eliminated	All Groups
High School	Mean	17.36	12.60	12.60	14.56
	S.D.	8.52	2.63	3.38	6.13
Technical School	Mean	11.75	18.00	11.67	14.06
	S.D.	4.60	1.73	4.01	4.37
Superior School	Mean	23.50	18.83	12.83	18.09
	S.D.	10.34	7.90	4.38	8.48

TABLE 12

ANALYSIS OF VARIANCE OF POSTTEST SCORES BASED ON EDUCATIONAL LEVEL AND TREATMENT GROUP

(Unweighted Means Analysis)

Source of Variation	df	ss	ms	F	p
Educational Level (A)	2	155.767	77.884	1.832	.174
Treatment Group (B)	2	179.528	89.764	2.111	.135
A X B	4	216.391	54.098	1.272	.300
Within Cells (Error)	33	1403.215	42.522		

Therefore, the null hypothesis is retained. There is no significant difference in student achievement based on educational level and there is no evidence of an educational level by treatment interaction.

Hypothesis 3

Stated in null terms, hypothesis 3 may be stated as follows:

> Three versions of the same instructional written material will result in equal levels of achievement of test items requiring different levels of processing.

As described in Chapter I, the posttest contained items requiring three levels of processing. The means and standard deviations of levels A, B, and C are shown in Table 13.

Since each subject in each group was observed under three conditions corresponding to the three levels of questioning, a two-factor analysis of variance design with repeated measures on one-factor was used to analyze the data. The results are presented in Table 14.

Since the data regarding treatment group are the same as the data analyzed in Table 2, it is not surprising that the F-ratio for the treatment main effect is exactly as reported in that table. The main effect for processing level is highly significant. An examination of the means indicates that students earned the lowest scores on items requiring deep processing. The interaction of treatment group and processing level is also statistically significant. This relationship is presented graphically in Figure 1.

TABLE 13

POSTTEST MEANS AND STANDARD DEVIATIONS CLASSIFIED ON THE BASIS OF TREATMENT GROUP AND LEVEL OF PROCESSING REQUIRED

Level of Processing		Treatment Group 1 Interspersed Version	2 Separated Version	3 Eliminated Version	All Groups
A. Minimum	Mean	7.75	5.39	5.82	6.32
	S.D.	3.82	2.00	2.03	2.88
B. Moderate	Mean	8.14	8.54	5.36	7.34
	S.D.	3.39	2.72	2.21	3.10
C. Deep	Mean	2.86	2.50	1.32	2.23
	S.D.	2.90	1.93	1.12	2.17

TABLE 14

ANALYSIS OF VARIANCE OF POSTTEST SCORES BASED ON PROCESSING LEVEL AND TREATMENT GROUP

(Repeated Measures Analysis)

Source of Variation	df	s	ms	F	p
Between Subjects					
Treatment Group (A)	2	93.155	46.477	3.122	.054
Error Between	39	581.935	14.921		
Within Subjects					
Processing Level (B)	2	616.333	308.167	121.709	.001
A X B	4	53.155	13.289	5.248	.001
Error Within	78	197.512	2.532		
Total	125	1542.089			

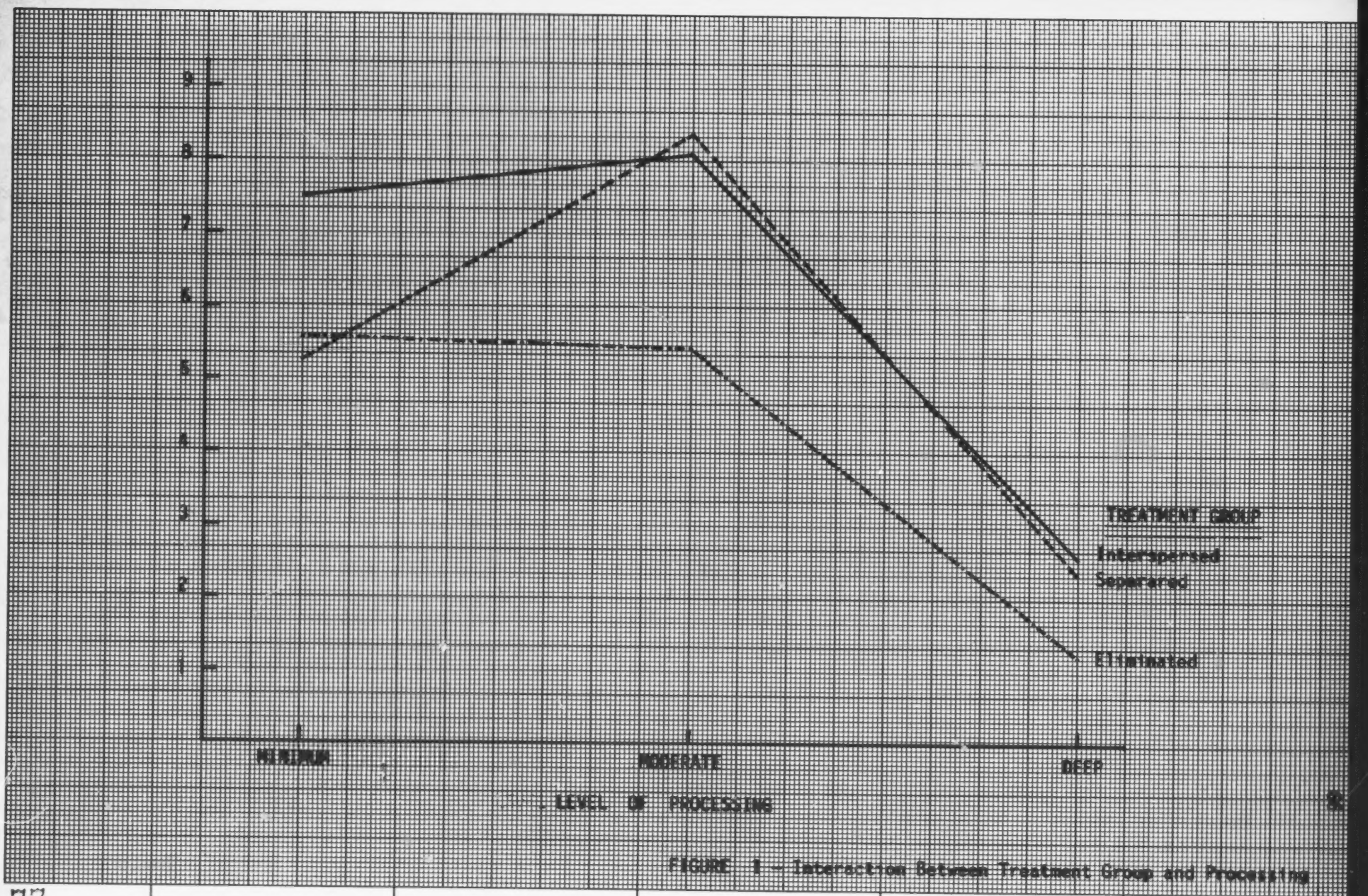

FIGURE 1 — Interaction Between Treatment Group and Processing

Chapter V

DISCUSSION

This study tested the general hypothesis that there would be a difference in the achievement attained by college students working with different forms of the same instructional material. It was assumed that a group receiving an organized text containing all the instructional aids that an instructional design demands (Interspersed Version) would have a higher achievement mean than a group receiving the same information without any instructional aids (Eliminated Version) and a group receiving the same information together with the instructional aids printed apart (Separated Version).

Analyses of the results obtained by the students on the posttest indicated that Group 1 (Interspersed Version) performed at a significantly higher level than Group 3 (Eliminated Version). Group 2 (Separated Version) showed achievement which stood in between those attained by Groups 1 and 3, but the differences found were not statistically significant.

The significant difference between Groups 1 and 3 supports numerous studies that have demonstrated the importance of instructional aids. Nevertheless, if attention is turned toward the comparison between M_2 and M_3, and if it is taken into consideration that Group 2 had exactly the same instructional aids as Group 1, an explanation about why $M_2 - M_3$ is not significant must be found. The question to be posed is therefore: what did the Interspersed Version have that the Separated Version did not, or what made $M_1 - M_3$ statistically significant? On comparing the Interspersed Version with the Separated

Version, it appears that they differed in several ways. The Interspersed Version was arranged according to complexity for instructional purposes, all new or technical terms were defined as soon as they appeared within the text, examples and exercises relating the parts were immediately linked to the explanations, and the information was given in a short and condensed form. In contrast, the Separated Version was presented in two booklets (Selected Readings and Study Guide); hence, the learner had to expend a certain amount of effort to integrate both parts. Many technical terms were not defined, since the texts in the selected readings were not written for beginners but for professionals and the examples were not given at each step of the explanation as in the Interspersed Version. The effects of these last two aspects were intended to be reduced by means of the Study Guide, since the main technical terms were defined there and examples were inserted as well, in the same terms as in the Interspersed Version. It seems, therefore, that the main differences consisted in the organized, graduated, linked sequence of information that existed in the Interspersed Version. This tends to confirm what has already been domonstrated in other settings, i.e., text organization and recall are positively related (Johnson, 1970; Meyer, 1975).

In addition to the characteristics of the different instructional materials, factors related to the study behavior of the learners may be examined. One of these factors was what the students did to facilitate their learning. The answers to questionnaire items 11.1 to 11.5 and 11.12 showed that although the same tasks were asked of Groups 1 and 2, students in Group 2 were not as active as students in

Group 1. Students in Group 2 did not report that they had reread the main parts, taken notes, made graphs, summarized, underlined, and followed the sequence of the text as often as students in Group 1. An examination of Tables 3, 4, 5, and 6 are helpful in interpreting these differences. Although Tables 4 and 6 do not shed light upon what could have affected Group 2 negatively, Tables 3 and 5 show that the frequency with which students reported that the material was pleasant, interesting, or motivating (questionnaire item 20, aspects 3, 5, 9, 10, and 12 and questionnaire item 30, aspects 1, 3, and 13) was higher in Group 1 than in Group 2. The quality and the quantity of exercises were also more appreciated (questionnaire item 30, aspects 2, 9, and 12) in Group 1 than in Group 2. Relating these observations to the fact that Group 3 which had no instructional aid at all also appeared more active than Group 2, it is plausible that the effort needed to integrate the two booklets produced a countermotivational effect. This effort might have discouraged the Group 2 learner from following the orientations given in the Study Guide.

With regard to question 29 which asked the students if they felt any desire to quit, no subject answered affirmatively and, at the end of the questionnaire (item 31), 70 percent of them said that they were happy to have been enrolled in the study, and that they would be interested in repeating a similar experience. Item 28 revealed that no subject felt the study to be too long. The data may indicate that distance education students need to feel that they are part of the university, that their opinions are taken into account, and that they may share experiences with others. In effect, distance education

students have little contact with professors; they study alone and only get together with peers when they are able to form a group on their own. This interpretation is supported by the comments of students on their satisifaction for having been enrolled by the university in the study. In addition, the aspects of the material that were appreciated by the students (Tables 3 and 5) indicate that they were willing to study contents related to their lives and to practical matters (questionnaire item 20, aspects 7, 14, 15, and questionnaire item 30, aspects 4, 7, 10, 14, 21, and 24).

In conclusion, organization, condensation, together with a certain kind of content that met the interests of adult learners were the factors which were most important for these students. The version studied also affected the behavior of the students during the learning situation; the activities of the students, what they did in the learning situation, was encouraged or inhibited according to the version to which they were assigned. Moreover, an examination of the responses to the questionnaire points to the fact that the versions also influenced motivation.

The second hypothesis pointed to the question of whether some types of instructional materials were more effective in relation to study behavior, age, and educational background. The results did not demonstrate any significant interaction between achievement and study behavior. Nevertheless, certain tendencies could be observed. In Group 1, the best achievement was attained by those who reported "frequent" study behavior and the worst by those who reported "some" application of study behavior. In Group 2, the best results were obtained by subjects who "sometimes" carried out the study behavior

and the worst by those who "never" applied it. With respect to Group 3, the highest scores were also attained with a non-frequent study behavior ("sometimes") and the lowest with no study behavior at all ("never").

It can be inferred that in the Interspersed Version, where the interspersed questions with their feedback were an integral part of the instructional design, studying the material without carying out the recommended activities would probably have led to the missing of some important information since questions were used as an instructional device and not as a checking device. On the contrary, in the Segregated Version, the carrying out of the recommended activities demanded frequent interruptions in the reading of the Selected Readings. Stopping to read often may have had two effects: (a) students became discouraged and distracted and (b) learning became more difficult. In spite of this, students of Group 2 attained their best mean scores when they carried out the study behavior. Curiously, in the Eliminated Version, students who "frequently" applied study techniques had a noticeably lower achievement than those who "sometimes" practiced the study behavior. This raises the question of what would have been the case for Groups 1 and 2 if they had had no orientation or enhancement as to what activity to perform while studying. The tendency in all groups was to avoid study techniques, since the total number of subjects who reported that they had "never" or "sometimes" used them, in all groups, was greater than the total number of subjects who reported that they had "frequently" used them. However, as mentioned above, achievement tended to be better among the

students to whom the study techniques were suggested and explained in the instructional material. Further studies are needed to diagnose what study techniques are actually employed by college students in Venezuela and how effective they are.

With regard to age and educational level as related to achievement, no statistically significant relations were evidenced. Nevertheless, an examination of Table 11 indicates that there was a tendency among students of higher educational levels in Groups 1 and 2 to obtain better scores than students of lower educational levels. In Group 3, however, no tendency could be observed in achievement as related to educational level. Further studies are needed to determine whether students of higher educational levels can better profit from instructional guidelines than lower educational level students.

This third hypothesis had the purpose of clarifying whether the instructional design could enhance a higher level of processing in the learner. Therefore, the posttest was constructed on the basis of three levels of processing as defined in Chapter I. Although all students obtained the lowest scores on items requiring deep processing, Groups 1 and 2 attained a higher mean score than Group 3. In addition, an interaction of treatment group and processing level was found. This confirms Greeno's findings that text materials which emphasize relationships among the parts of a structure, as the Interspersed and Separated Versions did tend to facilitate the learning of problem-solving strategies. Moreover, when levels of processing are related to what students reported they did while studying, mathemagenic behavior is apparent. The amount and type

of activity during the learning process may determine the level of processing the learner will reach with specific information.

Further studies with a greater sample of subjects are needed to confirm more precisely the results obtained in this study. Investigations must be undertaken in order to determine which of the variables that form part of an instructional design are actually essential and which interrelations among these variables have to be avoided in order to insure more effective learning. This study, nevertheless, demonstrated that different presentations of instructional written material affect learning in different manners and that deep processing, an important goal for higher education, can be enhanced by instructional strategies. These facts should be taken into consideration by teachers and administrators of distance education to support their decisions on what kinds of instructional materials should be chosen in order to meet the instructional objectives.

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APPENDIX A

POSTTEST

This appendix presents a translated version of the Posttest administered to all of the participants in this study.

POSTTEST

DIRECTIONS:

a) Read each of the following statements. If a statement is true, circle the "T." If a statement is false, circle the "F."

b) If a statement is false, change the underlined word (or words) to make the statement true. Place the new word in the blank space after the "F."

Example:

T	F	(matter)	1.	Nutriments are any kind of substance from which living beings may obtain water and energy.
T	F	_____	2.	A population is a set of individuals of the same species who live in a fixed place.

T F _____ 1. According to the Directorate of Special Education, nonspecific learning disabilities are psycho-neurological disorders.

T F _____ 2. In Venezuela we differeniate specific learning disabilities from nonspecific learning disabilities, according to Johnson and Myklebust.

T F _____ 3. Since the cause of specific learning disabilities is unknown, it is frequently said that they are psychoneurological.

T F _____ 4. The brain has the property of transduction, which is the property of being able to transform one kind of energy or information into another.

T F _____ 5. A synonym for generalized disability is pedagogical retardation.

T F _____ 6. Definitions of specific learning disabilities that have an etiological approach are those which point out the behavior present in the disturbance.

T F _____ 7. Specific learning disabilities are due to factors external to the individual.

T F _____ 8. When school performance is low due to sociocultural disadvantages it is generally referred to as global learning disability.

T F _____ 9. When people function intellectually below the population average due to sociocultural disadvantages, they are referred to as mentally retarded.

T F _____ 10. The Directorate of Special Education is especially interested in assisting individuals with learning disabilities in nonverbal subjects.

DIRECTIONS:

Read the following description and answer questions 11 and 12.

Angela S., 10 years old, is finishing second grade.	
Reference Reason:	She reads as a pupil at the first grade level.
Physical Examination:	General condition, adequate. Low height.
Evolutive Development:	Nothing special. Originates from very low socioeconomic background. Parents are frequently absent. She takes care of her younger brothers.
School Antecedents:	Absenteeism. Low achievement in all school subjects, except in gymnastics and drawing. The school has often changed the teachers in her classroom.
Psychological Study:	I.Q. 98; some agression.

11. This general description does not allow us to diagnose the case. Nevertheless, with the available antecedents, we may suppose that -- once the study finished -- we will probably find some causal relationships that will be able to explain Angela's

low level of achievement. These casual relationships will probably be found between the pupil's achievement and

A. her emotional problems

B. her low intellectual level

C. her sociocultural disadvantages

D. her motor integrity

12. According to these few data, we may draw a prior -- tentative -- hypothesis that Angela's case is a case of a probable

A. specific learning disability

B. nonspecific learning disability

C. psychoneurological learning disorder

D. mental retardation

DIRECTIONS:

Circle the option which completes or answers questions 13 to 19.

13. Specific learning disabilities have been defined in many different ways according to different approaches. The authors who adopt an educational approach define S.L.D.

A. emphasizing the cause of the disturbed behavior of L.D. children

B. bounding their definition to an as objective as possible description of the essential characteristics of L.D. children

C. describing the neurological processes which are disturbed in L.D. children

D. eliminating psychoneurological etiologies and referring primarily to the emotional disturbances existing in L.D. children

14. The fact that the nervous system is organized in subsystems which, occasionally, function in a semi-autonomous manner, would partly explain the

A. idiopathic nature of specific learning disabilities

B. etiology of specific learning disabilities

C. difficulties that characterize the treatment of learning disabilities

D. specificity of the specific learning disabilities

15. From the point of view of an educator, specialized in L.D., the most useful case descriptions for remedial programming are those which indicate the

A. location of the brain damage of the L.D. individual

B. set of behavioral symptoms of the L.D. individual

C. relationships between the brain damage and the learning disturbance

D. location and extension of the brain damage of the L.D. pupil

16. In our country, if we compare the incidence of the cases of low school achievement due to specific learning disabilities with the incidence of the cases of low school achievement due to global disabilities, we find that

A. we do not yet have data which can provide some indicators about incidence (higher or lower)

B. it is of undetermined quantity, but probably higher

C. informal observations done in Special Classrooms allow us to suppose that the incidence is lower

D. informal observations done in Special Classrooms allow us to suppose that the incidence is higher

17. The following list gives characteristics that some pupils may present:

1) normal intelligence

2) superior intelligence

3) mental retardation

4) school achievement unexpectedly low when compared with their capacity

5) deficient cultural background

6) severe sensory loss

7) severe emotional disturbance

Which of the above characteristics are those which cannot be prominent in a case of specific learning disability, according to Bateman?

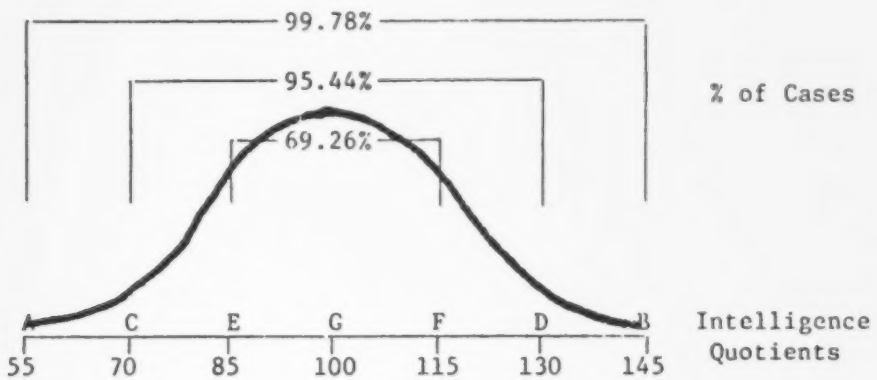
A. 1 - 2 - 3 - 4

B. 2 - 4 - 5 - 6

C. 3 - 5 - 6 - 7

D. 4 - 5 - 1 - 3

18. The following graph shows the distribution of the I.Q. that people of any population present when they are administered an intelligence test.



Using the definition of specific learning disabilities given by the Directorate of Special Education, we may say that children with specific learning disabilities can be found

A. between the limits pointed out by letters A and B

B. between the limits pointed out by letters C and D

C. between the limits pointed out by letters E and F

D. at point G

19. Mrs. Figueroa, a teacher of third grade, believes that 11-year-old Juana O., of normal intelligence, has specific learning disabilities because

- Juana reads with a retardation of two years when compared with her fellow classmates

- Juana presents severe emotional disturbance which seems to provoke the learning problem

- Juana has not suffered from any cultural deprivation: her parents are middle class professionals and she has received conventional instruction since she was five years old.

Taking as a reference point the definition of specific learning disabilities of the Directorate of Special Education, we find that this teacher's point of view is

A. correct, because discrepancy is a prominent characteristic of this pupil

B. possibly correct, because the pupil has been receiving school attention for a long time

C. incorrect, because the teacher assumes that the cause of the disability is emotional

D. possibly incorrect, because the pupil presents a normal intellectual level

20. The word "psychoneurological" applied to learning problems indicates that the

A. psychological factors produce a disturbance in behavior

B. behavior of the individual is based upon a neurological substratum

C. problems -- of a psychological nature -- produce neurological disturbances

D. behavioral problems derive from neurological disturbances

21. Among the data of a 10-year-old boy pupil, examined by the Psychopedagogical Service because of achievement problems, the following are prominent:

Age:	10 years old
Reference Reason:	low achievement in arithmetic
I.Q.:	110
Evolutive Development:	ability to sit, to grasp, to walk, and language development: normal
Conclusion:	specific learning disability in arithmetic

The conclusion is incorrect. We know that in order to give a conclusion of this kind we need basic supportive data. In this case, the Service was lacking enough data to reach that conclusion.

Read the following antecedents. Circle those which, in your opinion, were missing to support the conclusion:

A. measurement of the actual achievement of the pupil in arithmetic

B. indication of his mental ability

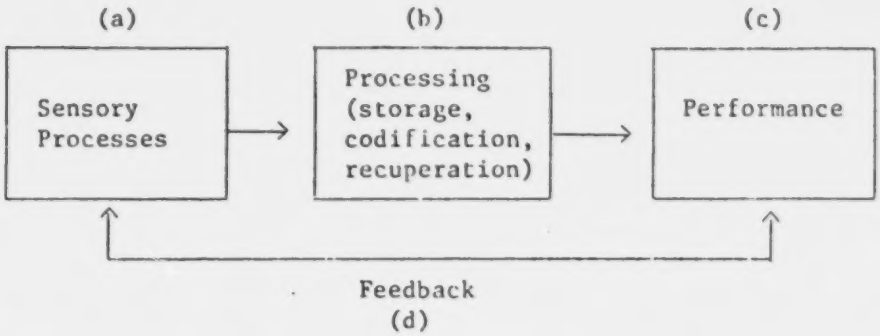
C. history of his physical and behavioral development

D. sociocultural environment where he grew up

E. grade he is attending

F. information about his sensory conditions

22. The following graph outlines the process by which the organism processes the information it receives from the environment.



Some of the parts of this process may be observed by the professional and some can only be inferred. Identify which parts -- described by letters a, b, c, and d -- may be directly observed by the professional:

A. a - b - c - d

B. a - b - d

C. a - c

D. c

DIRECTIONS:

Study the following description and answer questions 23 to 28; circle one option which best completes or answers the statement.

> In a school of Caracas, the fourth grade teacher refers Andrés to the Psychopedagogical Service; she asks for a specialized study because she would like to know how to help Andrés in reading. From the teacher's point of view, Andrés is a 10-year-old boy, "smart," with an adequate general achievement, but with a reading level which actually corresponds to second grade. He makes a lot of mistakes and evidences a lot of hesitation when reading; for example, he frequently confounds letters "a" and "e," "b" and "d," "p" and "q."
>
> The Psychopedagogical Service, after several studies, concludes that:
>
> - Andrés' I.Q. is 115
>
> - he has a slight myopia, overcome by means of appropriately graduated lenses
>
> - he has an adequate emotional adjustment. He evidences some insecurity when he reads aloud.
>
> Andrés is believed to have a specific reading disability related to a brain dysfunction which evidences particularly in problems of selective attention: his attention scatters easily, it is attracted by too many stimuli and Andrés is not able to concentrate on tasks that are relevant to finishing school work.

23. In Andrés' case we observe something which is called disparity. If we apply Bateman's criterion, the disparity here is significant because

    A. there is a difference of two years between Andrés' reading level and the level to which he should correspond.

    B. Andrés' I.Q. is superior and his reading performance is inferior

    C. Andrés' reading does not correspond to a fourth grade level

    D. there is a noticeable imbalance between Andrés' reading level and his reading performance

24. The approach of those who wrote the description of Andrés' case is

    A. behavioral

    B. etiological

    C. idiopathic

    D. pedagogical

25. If we analyze the description of Andrés' case taking as a reference point Bateman's definition of specific learning disabilities, we may conclude that

    A. it could be a specific learning disability because the observed discrepancy corresponds to the discrepancy which Bateman describes and because there are signs of brain dysfunction

    B. this case corresponds to a specific learning disability because there are no emotional disturbances

    C. this case may perhaps not correspond to a specific learning disability because Andrés' educational background is not described

    D. this description may perhaps not correspond to a specific learning disability because there are some sensory losses of a visual kind and some emotional maladjustment

26. Andrés' myopia may be considered as a problem of the following kind

    A. central

    B. psychoneurological

    C. peripherial

    D. determinant

27. The fact that Andrés confuses letters of similar shapes (which only differ in detail) makes us suppose that there is a problem which is fundamentally at the following level

    A. input

    B. information procession

    C. output

    D. feedback

28. When we say that "it is believed" that Andrés has a specific learning disability, a definitive conclusion is not being given. The reason for this is that the diagnoses

A. depend on the number of professionals who have been involved in the previous observations which support the diagnosis

B. belong to the category of inferences; hence, their subjective component is recognized

C. are only given in a definitive manner when the professionals who make them have a recognized professional status

D. proceed from the field of medicine and, for this reason, must be avoided in special education

DIRECTIONS:

Observe the writing errors (in dictation) of C.E., a nine-year-old boy. He is in the third grade and receives special help because of reading and writing problems. Answer questions 29 and 30 (circle the right option).

El Regalos de Cumpleaño
Mi papa me yeno de paseo.
Vimos a la montaña y nos
Subimos en el teleasiso. que
es nomo regalo recivi en
Mi Cumpliaños

(The original text said: El regalo de cumpleanos. Mi papa me llevo de passeo. Fuimos a la montana y nos subimos al teleferico ¡Que hermoso regalo recibi en mi cumpleanos!)

29. The errors in dictation are evidence of some auditory distortions which we have underlined. Therefore, we may say that C.E. shows problems in the processes of

A. input

B. integration

C. output

D. feedback

30. These problems seem to proceed from disturbances of the processes of

A. input

B. integration

C. output

D. feedback

DIRECTIONS:

Read the following summary of a historical case in the field of learning disabilities.

"A boy, 12 years of age, was brought in March 1902 to the Eye Infirmary by his mother, to see if there was anything wrong with his eyesight. The boy has been seven years at school, and there had been from the outset the greatest difficulty in teaching him to read. The boy should have been in Standard V, but was now, after seven years, only in Standard II, and he could not get out of it because of of his reading. He had made no complaint whatever about his vision, but his mother had brought him to the Eye Infirmary in order to discover if his eyesight had anything to do with his difficulty. His mother stated that he was in every other respect a sharp and intelligent boy. He had no difficulty with arithmetic, and could keep up with the other students easily in this department. He was now working at compound addition. His mother said that the other boys laughed at him in class, and that when he became excited his reading was worse than ever. He concealed his defect for a time by learning his lesson by heart. His auditory memory, therefore, was evidently very good. On examining him I found that his reading was very defective for a boy who had been seven years in school. He could rarely read by sight more than two or three words, but came to a standstill every second or third word, and was unable to proceed unless he was allowed to spell out the word aloud, thus appealing to his auditory memory, or to spell it silently with his lips, thus appealing to his memory of speech movements . . . . He read all combinations of figures with the greatest fluency up to millions. I made him do several sums up to compound addition . . . . I wrote to his schoolmaster for information about the boy. He replied that the lad had experienced throughout his whole career in the school the greatest difficulty in learning to read, which had kept him very much behind in his progress through the school. He was strong in arithmetic, good at spelling, and average in other subjects, including geography and history. 'I have however,' said the master, 'seen a case similar to this one in my twenty-five years' experience as a teacher. There is another boy in his class who is quite a poor reader, but this other boy shows no sign of smartness in anything.'" (Hinshelwood, J., 1917).

31. Give three reasons why this could be a case of specific reading disability:

_____

_____

_____

_____

32. Although there are not enough data about the second case , indicate which kind of case the other pupil mentioned at the end of the teacher's letter might probably be

A. a nonspecific learning disability

B. a specific learning disability

C. a general learning disability

D. intellectual dificiency

33. In order to correct educationally the learning difficulties of these two boys, circle in the following list the professional who would be best in each case

A. primary school teacher

B. specialist in mental retardation

C. teacher, specialized in learning disabilities

For pupil No. 1: _____

For pupil No. 2: _____

34. Briefly write what you believe to be specific learning disabilities:

_____

_____

_____

_____

_____

THANK YOU FOR YOUR COOPERATION.

TABLE OF SPECIFICATIONS AND ANSWER KEY FOR THE POSTTEST

Item	Objective	Level	Answer	Level
1	2	A	F (specific)	1
2	2	A	F (Spec. Ed.)	1
3	3	A	F (idiopathic)	1
4	6	A	T	1
5	1-6	A	F (mental)	1
6	3	A	F (cause)	1
7	1	A	F (internal)	1
8	1	A	T	1
9	6	A	F (pseudo M.R.)	1
10	1-6	A	F (instrumental)	1
11	1	B	C	1
12	1	B	B	1
13	3	A	B	1
14	6	A	D	1
15	5	A	B	1
16	1	A	C	1
17	5	A	C	1
18	6	B	B	1
19	2-5	B	C	1
20	6	A	D	1
21	1-5	B	A, B, D, E, F	4
22	6	B	D	1
23	6	B	A	1
24	3	B	B	1
25	2	B	A	1
26	6	B	C	1
27	4	B	A	1
28	1	B	B	1
29	4	B	C	1
30	4	B	A	1
31	5-1	C	- Significant discrepancy - Normal intelligence - Normal experience (stimulation) - Disability specific to one area - Sensorial and emotional integrity	3
32	6	B	D	2
33	1	B	- D.A. specialist - R.M. specialist	2
34	1	C	five characteristics	5

APPENDIX B

QUESTIONNAIRE

This Appendix presents a translated version of the questionnaire administered to all of the participants in the study. On pages 97 - 106 the questionnaire used with Groups 1 and 2 is presented; on pages 107 - 115 the questionnaire used with Group 3 is presented.

QUESTIONNAIRE
(Administered to Groups 1 and 2)

1. Name _____

2. Age _____

3. Educational Level _____

STUDIES PERFORMED (indicate the field)	LEVEL REACHED
High School	_____
Technical Studies a) _____ b) _____ c) _____ d) _____	 a) _____ b) _____ c) _____ d) _____
Higher Education a) _____ b) _____ c) _____ d) _____	 a) _____ b) _____ c) _____ d) _____
Post-graduate Studies a) _____ b) _____ c) _____ d) _____	 a) _____ b) _____ c) _____ d) _____

4.0 How long had you not been studying before you entered U.N.A.?

(Years and months) _____

5.0 What is your present occupation? _____

6.0 Do you have a paid job?

6.1 Yes ☐ ↓ 6.2 No ☐ → pass to question 9.0.

6.1.1 Indicate how many jobs you have _____

6.1.2 What kinds of job(s) do you have? _____

_____

_____

7.0 How many hours do you devote to work each week? _____

8.0 Do you have people under your economic responsibility?

8.1 Yes ☐ ↓ 8.2 ☐ → pass to question 9.0.

8.1.1 Indicate the number of persons who depend on you _____

9.0 How many sessions did you need to study the material we gave you? (indicate with an X).

Number of Sessions	1	2	3	4	5	6	7	8	9	10 more
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

10.0 How long in total did it take you approximately to study the material? (indicate hours and minutes) _____

11.0 How did you study the material? Did you just read it (in one or several sessions) and then go on to the present meeting?

11.1 Yes ☐ → pass to question 12.0.

11.2 No ☐ ↓

Pass to next page.

Indicate how you studied:

	Very Often	Frequently	Sometimes	Rarely	Never
1. You reread the main parts					
2. You took notes					
3. You drew graphs					
4. You made abstracts					
5. You underlined what seemed important to you					
6. You answered every question					
7. You compared your answers with the answers in the text					
8. You used a Spanish dictionary to clarify some doubts					
9. You used a specialized dictionary to clarify some doubts					
10. You read the additional bibliography					
11. You tried to get additional bibliography and could not get any					
12. You followed the indicated sequence					
13. You changed the sequence of the material					

	Very Often	Frequently	Sometimes	Rarely	Never
14. You asked a fellow student or a friend for help					
15. You asked a specialist for help					
16. You sought counseling at the Local Center					

12.0 In order to learn this material, did you review?

12.1 Yes ☐ 12.2 No ☐ → pass to question 13.0.

↓

12.1.1 How many times? _____

12.1.2 How long approximately? _____

12.1.3 Indicate when:

- before each study session? _____
- before some study sessions? _____
- after the study sessions? _____
- before the present meeting? _____

13.0 Were you interested by the material?

13.1 Yes ☐

13.2 No ☐

13.3 Explain why _____

_____

_____

14.0 Did you have any information about learning disabilities before studying the material?

14.1 Yes ☐

14.2 No ☐

15.0 Did you acquire some new knowledge from the material?

15.1 Yes ☐ 15.2 No ☐

15.3 Explain _____

_____

_____

16.0 Do you think that you learned the material we gave you?

16.1 Yes ☐ 16.2 No ☐ → pass to question 17.0.

↓

Pass to next page.

16.1.1 If you answered affirmatively, do you believe that any of the following aspects of the material may have made your learning easier? (indicate with an X)

	Much	Somewhat	Not at all
1. Introduction			
2. Objectives			
3. Organization of the text			
4. Explanations inserted in the text			
5. Examples of the text			
6. Exercises			
7. Answers given to the exercises			
8. Style of the text			
9. Illustrations			
10. Additional comments			
11. All the above marked aspects as a whole			

16.1.2 If none of the above aspects made your learning easier, and if you considered that other aspects did, indicate which aspects they were _____

_____

_____

17.0 Would you have preferred the information to have a different presentation?

17.1 Yes ☐ ↓ 17.2 No ☐ ⟶ pass to question 18.0.

17.1.1 Explain how _____

_____

_____

_____

18.0 Did you have any doubts or confusion during your study of the material?

18.1 Yes ☐ 18.2 No ☐ → pass to question 19.0.

18.1.1 What were they? _____

_____

_____

18.1.2 If you could solve them, how did you do so?

_____

_____

18.1.3 If you could not, explain why. _____

_____

_____

19.0 Do you think that something may be missing in the study material you received?

19.1 Yes ☐ 19.2 No ☐ → pass to question 20.0.

19.1.1 Explain _____

_____

20.0 Is there any specific aspect of this material that you especially liked?

20.1 Yes ☐ 20.2 No ☐ 20.3 Explain _____

_____

_____

21.0 Is there any specific aspect of the material that you disliked?

21.1 Yes ☐ 2.12 No ☐ 21.3 Explain _____

_____

_____

22.0 Do you believe there is any difference between the study material we gave you for the present research and the texts produced by U.N.A. that you already know?

22.1 Yes ☐ 22.2 No ☐ → pass to question 23.0.

↓

22.1.1 Do you consider that the difference facilitates learning? _____

22.1.2 Explain how this material influenced your learning. _____

_____

_____

23.0 Do you believe that there is any difference between the instructional material you received for the present research and a common textbook?

23.1 Yes ☐ 23.2 No ☐ → pass to question 24.0.

↓

23.1.1 Explain how the difference affected your learning. _____

_____

_____

24.0 Did the kind of exercises included in the material influence your learning?

24.1 Yes ☐ 24.2 No ☐

24.3 Explain how it affected your learning. _____

_____

25.0 With regard to the exercises interspersed in the text,

25.1 Indicate some positive aspects they might have _____

_____

25.2 Indicate some negative aspects they might have _____

_____

26.0 Did you look for additional information about learning disabilities after studying the material we gave you?

26.1 Yes ☐ 26.2 No ☐ → pass to question 27.0.

↓

26.1.1 Explain where you looked for information?

1. In Books _____
2. In reviews _____
3. With advanced students _____
4. Other students _____
5. A counselor or an adviser _____
6. Other sources _____

27.0 Do you want to know more about learning disabilities after studying this material?

27.1 Yes ☐ 27.2 No ☐

27.3 Why? _____

_____

28.0 Did you find that the material took a long time to study?

28.1 Yes ☐ 28.2 No ☐

28.3 Why? _____

_____

29.0 Did you ever desire to drop out of the study?

29.1 Yes ☐ 29.2 No ☐ → pass to question 30.0.

↓

29.1.1 What induced you to carry on with this research? _____

_____

_____

30.0 Indicate three positive and three negative aspects of the instructional material we gave you. _____

_____

_____

_____

_____

_____

31.0 Is there any additional comment on the instructional material that you want to make? _____

_____

_____

_____

_____

_____

_____

QUESTIONNAIRE
(Administered to Group 3)

1. Name _____

2. Age _____

3. Educational Level _____

STUDIES PERFORMED (indicate the field)	LEVEL REACHED
High School	_____
Technical Studies a) _____ b) _____ c) _____ d) _____	 a) _____ b) _____ c) _____ d) _____
Higher Education a) _____ b) _____ c) _____ d) _____	 a) _____ b) _____ c) _____ d) _____
Post-graduate Studies a) _____ b) _____ c) _____ d) _____	 a) _____ b) _____ c) _____ d) _____

4.0 How long had you not been studying before you entered U.N.A.?

(Years and months) _____

5.0 What is your present occupation? _____

6.0 Do you have a paid job?

6.1 Yes ☐ 6.2 No ☐ → pass to question 9.0.

↓

6.1.1 Indicate how many jobs you have _____

6.1.2 What kinds of job(s) do you have? _____

_____

_____

7.0 How many hours do you devote to work each week? _____

8.0 Do you have people under your economic responsibility?

8.1 Yes ☐ 8.2 ☐ → pass to question 9.0.

↓

8.1.1 Indicate the number of persons who depend on you _____

9.0 How many sessions did you need to study the material we gave you? (indicate with an X).

Number of Sessions	1	2	3	4	5	6	7	8	9	10 more
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

10.0 How long in total did it take you approximately to study the material? (indicate hours and minutes) _____

11.0 How did you study the material? Did you just read it (in one or several sessions) and then go on to the present meeting?

11.1 Yes ☐ → pass to question 12.0.

11.2 No ☐

↓

Pass to next page.

Indicate how you studied:

	Very Often	Frequently	Sometimes	Rarely	Never
1. You reread the main parts					
2. You took notes					
3. You drew graphs					
4. You made abstracts					
5. You underlined what seemed important to you					
6. You answered every question					
7. You compared your answers with the answers in the text					
8. You used a Spanish dictionary to clarify some doubts					
9. You used a specialized dictionary to clarify some doubts					
10. You read the additional bibliography					
11. You tried to get additional bibliography and could not get any					
12. You followed the indicated sequence					
13. You changed the sequence of the material					

	Very Often	Frequently	Sometimes	Rarely	Never
14. You asked a fellow student or a friend for help					
15. You asked a specialist for help					
16. You sought counseling at the Local Center					

12.0 In order to learn this material, did you review?

12.1 Yes ☐ 12.2 No ☐ → pass to question 13.0.

↓

12.1.1 How many times? _____

12.1.2 How long approximately? _____

12.1.3 Indicate when:

- before each study session? _____
- before some study sessions? _____
- after the study sessions? _____
- before the present meeting? _____

13.0 Were you interested by the material?

13.1 Yes ☐

13.2 No ☐

13.3 Explain why _____

_____

_____

14.0 Did you have any information about learning disabilities before studying the material?

14.1 Yes ☐

14.2 No ☐

15.0 Did you acquire some new knowledge from the material?

15.1 Yes ☐ 15.2 No ☐

15.3 Explain _____

_____

_____

16.0 Do you think that you learned the material we gave you?

16.1 Yes ☐ 16.2 No ☐ → pass to question 17.0.

↓

Pass to next page.

16.1.1 If you answered affirmatively, do you believe that any of the following aspects of the material may have made your learning easier? (indicate with an X)

	Much	Somewhat	Not at all
1. Introduction			
2. Objectives			
3. Organization of the text			
4. Explanations inserted in the text			
5. Examples of the text			
6. Exercises			
7. Answers given to the exercises			
8. Style of the text			
9. Illustrations			
10. Additional comments			
11. All the above marked aspects as a whole			

16.1.2 If none of the above aspects made your learning easier, and if you considered that other aspects did, indicate which aspects they were _____

_____

_____

17.0 Would you have preferred the information to have a different presentation?

17.1 Yes ☐ 17.2 No ☐ → pass to question 18.0.

↓

17.1.1 Explain how _____

_____

_____

_____

18.0 Did you have any doubts or confusion during your study of the material?

18.1 Yes ☐ 18.2 No ☐ → pass to question 19.0.

18.1.1 What were they? _____

_____

_____

18.1.2 If you could solve them, how did you do so?

_____

_____

18.1.3 If you could not, explain why. _____

_____

_____

19.0 Do you think that something may be missing in the study material you received?

19.1 Yes ☐ 19.2 No ☐ → pass to question 20.0.

19.1.1 Explain _____

_____

20.0 Is there any specific aspect of this material that you especially liked?

20.1 Yes ☐ 20.2 No ☐ 20.3 Explain _____

_____

_____

21.0 Is there any specific aspect of the material that you disliked?

21.1 Yes ☐ 2.12 No ☐ 21.3 Explain _____

_____

_____

22.0 Do you believe there is any difference between the study material we gave you for the present research and the texts produced by U.N.A. that you already know?

22.1 Yes ☐ 22.2 No ☐ → pass to question 23.0.

↓

22.1.1 Do you consider that the difference facilitates learning? _____

22.1.2 Explain how this material influenced your learning. _____

_____

_____

23.0 Do you consider that there is any difference between the study material you received for the present research and a common textbook?

23.1 Yes ☐ 23.2 No ☐ → pass to question 24.0.

↓

23.1.1 Explain how the difference affected your learning. _____

_____

_____

24.0 Did you look for additional information about learning disabilities after studying the material you received from us?

24.1 Yes ☐ 24.2 No ☐ → pass to question 25.0.

↓

24.1.1 Explain where you looked for information:

1. In books _____
2. In reviews _____
3. With advanced students _____
4. Other students _____
5. A counselor or an adviser _____
6. Other sources _____

25.0 Do you want to get more information about learning disabilities after studying this material?

25.1 Yes ☐ 25.2 No ☐

25.3 Why? _____

_____

26.0 Did you find it took a long time to study the material?

26.1 Yes ☐ 26.2 No ☐

26.3 Why? _____

_____

27.0 Did you ever desire to drop out of the study?

27.1 Yes ☐ 27.2 No ☐ ⟶ pass to question 28.0.

↓

27.1.1 What induced you to continue in the research?

_____

_____

_____

28.0 Indicate three positive and three negative aspects of the instructional material you studied. _____

_____

_____

_____

_____

_____

_____

29.0 Is there any additional comment on the instructional material that you want to make? _____

_____

_____

_____

_____

_____

_____

APPENDIX C

INSTRUCTIONS AND INFORMATION

This appendix presents in translation two pieces of information given to the participants in this study.

Appendix C.1

INTRODUCTION

The National Open University is an ambitious innovation in higher education. In its aspiration to reach an optimum level of academic excellence, the university considers that research, especially educational research, should be one of its priorities.

At the present, the area of Education is carrying out a research study on instructional materials for distance education. Among all the students in the area of Education, we selected the candidates in the field of Learning Disabilities to ask them to cooperate in the above mentioned research.

If you decide to give us your help, it will consist in studying instructional material that we will give you as soon as you give us an affirmative response. The maximum time required to perform this task is approximately 20 hours (although it could be much less). You will take the material home with you and study it in your free time. After this, you will return to this same place, on October the _____th, at 8:30 a.m. for a meeting that will take two hours at the most.

The cooperation we are asking you to give us is fundamental for the achievement of the present research. We hope that the results will allow us to draw conclusions that will improve our instructional approach and, hence, the educational support that we will be giving you in the future.

If you agree to participate, let us know now. If you do not, please leave this text on the table.

We thank you very much for your cooperation, and hope that this experience, if you decide to participate, will contribute to the education we wish to offer you in the field of Learning Disabilities.

Appendix C.2

INFORMATION

You are now entering the second phase of the research you are involved in and we believe that it is a good moment to enlarge your understanding of the activity in which you are participating.

You have probably observed that not all your fellow members received the same study material. The reason for this is that we intend to measure the effects of different instructional materials, in order to draw useful conclusions which will be of help in the elaboration of our future books.

The task we are going to ask you to follow now is simple. First, we will ask your opinion about several subjects related to the employment of the material you have had to study. Next, you will receive a questionnaire about the contents of the material you have studied. We hope that you answer as sincerely as possible since we are looking for information on the group reaction as a whole, and not the individual grades each one of you is going to obtain.

This research has a third and last phase. In order to carry out this phase, we are asking you to return to the Liceo Gustavo Herrera, next month (on November, the 27th, Saturday) at 8:30 a.m., for a meeting similar to the present one; it will be of approximately one hour.

At the end of this work session, we will be at your disposition for any information you may wish to obtain about the career of Learning Disabilities. Finally, we again thank you very much for your cooperation.

APPENDIX D

- Some methological remarks on the study
  (by R. Schuemer)

- The author's reply (Anne Benkö de Rotaeche)

R. Schuemer:

Some methodological remarks on the study

(1) In my opinion the main difficulty in testing hypotheses derived from cognitive (instructional) theories seems to be that many concepts and terms from the field of cognitive theories (e.g. hierarchical structures, 'depth of cognitive processes', scheme and concept learning, 'inspection respectively mathemagenic behaviors' etc.) certainly are illustrative but also quite imprecise. To me above all it seems that clear operational definitions are missing in this field (compare, for example, the quotation of Rumelhart & Ortony on p. 28).

(2) The subject of the empirical part of the investigation is the evaluation of three didactical instruction conditions or versions. Hypothesis 1 and the test made for it (univariate variance analysis) imply an overall comparison of the achievements of the posttest following the completion of the course (the latter is developed in accordance with the respective instructional condition).

Such overall tests produce some interpretational problems:

- Instructional conditions usually consist of various didactical elements or can be interpreted as combinations of such elements, but only the global effect of the instructional conditions resp. versions can be tested. Therefore it remains unsolved which individual components of the instruction contribute to the hypothesized better achievement under certain instructional conditions. So, even if the achievements are better after a certain type of instruction than after the others, one does not know which component of the instruction has lead to that improvement.

- Instructional/didactical elements (as, for example, 'stimulation elements' or 'illustrations') cannot be regarded without simultaneously considering the instructional contents; what may have an positive effect in connection with one certain subject matter may be absolutely ineffectual (or even troublesome) in another(impossibility of generalization).

- A didactical treatment of instructional texts may also lead to alterations of contents. To insert exercises or 'advance organizers' in an instructional text, for example, seems to change at least the redundancy of the text and may possibly even influence the structure of the contents.[1] This may also be valid for the stressing of certain facts, points or parts of the text which puts other parts in the background. The question therefore is whether (possible) differences in achievement after the completion of courses with different didactical treatment are caused purely by the didactical treatment or also by - the thereby changed - contents (problem of confounding).

- With regard to this problem it is not clear to me why for the second (separated) - and also for the third (eliminated) - version/instructional condition another text has been used than for the first condition ('interspersed'). Admittedly, it is said on p. 42 that the material 'corresponds in content to the "instructional text" of the first version', but still it cannot be excluded that it differs from the first versions not only in the didactical presentation but also in contents.

The above indications of some problems which (often) occur in studies of this kind should not really be taken as criticism[2], but as a suggestion for readers or 'consumers' of such evaluation studies to bear in mind the limits of the investigation's approach.

---

1) The cognitive structuring of contents by the learner left aside.

2) If it is criticism at all, then it is also self-criticism: the author was co-author of a study which was carried out on the basis of exactly the same approach (cf. Holmberg, Schuemer & Obermeier 1982).

(3) Finally some rather technical details:

(a) Design (pp. 49 - 50)

Good arguments can be cited as well for as against 'posttest only' designs; the same could be said regarding 'pretest/posttest' designs. The advantage of the 'posttest only' design is that possible 'facilitative effects' (or other similar effects produced by repeated measurement) can be avoided; on the other hand problems may result in this type of design if

- there are great individual differences between subjects before treatment (the test of hypotheses then will not be very efficient)
- the groups of subjects investigated under each instructional condition are very small (only 14 (!) under each condition in the test of the main hypotheses 1 - see p. 48)

and/or if

- there is reason to assume that the groups under the various conditions differ in some systematical way.

The 'pretest/posttest' design may help to avoid some of these problems: one can analyse the differences between posttest and pretest scores thereby abstracting interindividual differences before treatment (or one can use the pretest scores as a covariate in an analysis of covariance).

A combination of both design types would be optimal, for example as follows:

group 1	group 2
--	pretest
treatment	treatment
posttest	posttest

(b) Operational definitions of the dependent variables

It is not clear to me how the posttest score is defined exactly - for example: Is it the number of correct answers? (Then a non-parametric method of analysis - e.g. the H-test of Kruskal-Wallis or another homologous test - would seem to be preferable.)

Also the (operational) definition of the three 'levels of processing' for hypotheses 3 is not clear to me (compare also pp. 8 - 9 'dependent variables').

To make use of an analysis of variance for the test of hypothesis 3 seems to me - to express it cautiously - somehow doubtful. The method used is a univariate analysis of variance with two independent factors: F_1 = treatment (i.e. version) and F_2 = processing level.
The dependent variable is the achievement; since the latter is assessed on the different levels of F_2 by differing items in the posttest, not just one dependent variable but three different dependent variables are analysed; this seems to drift towards a comparison between apples and pears. The 'highly significant' main effect of the 'processing level' (p. 65) may not reflect anything but the considerably varying numbers of items for the three processing levels (cf. Tab. on p. 95); for similar reasons it is hardly possible to interpret the interaction.

(c) Expectation 2 really is a (treatment x learner variables) interaction hypothesis, which - theoretically seen - absolutely makes sense. Since the learner variables (age, background etc.) are classification variables and therefore cannot be set or changed arbitrarily by the researcher unequal cell frequencies will probably occur. This non-orthogenality of design may cause difficulties in interpreting the F-test for the interaction term. There is an indication (on pp. 59 - 64) of such problems having occurred in this case; regrettably it is only mentioned that there are unequal cell frequencies, but the N per cell in the analyses of variance is not stated there (Tab. 7 - 11).

Furthermore, the F-tests for the 'treatment' main effect differ between each other in the analyses for the hypotheses 2a - 2c.[1)] These irritating results may be caused by each effect being adjusted for the other effects in the design; nothing is said about this, however.

1) And all these tests differ from the analogous test in the analysis for hypotheses 1 (p. 52).

The author's reply

In a letter of July 1987 Anne Benkö de Rotaeche commented on R. Schuemer's methodological remarks. With regard to the first remark she writes: "I recognize it surprised me: I was not aware of these lacks of operational definitions ... perhaps because I adopted the general trend in the literature."[1)]

Her answers to the other remarks give further information about the methods and variables of the study and are therefore reproduces in total below:

(2)

- **Effects of the individual components of instruction:** I agree that this effect remained untested (p. 73), but I could not find any technical procedure to elucidate it, in spite of the fact it was one of my principal concerns at the beginning.

- **Relationship between the didactical elements and the content:** I am aware of the strong relationship that should exist between the didactical procedures and the content. I really think that content - and what the student already knows about it, when this can be assessed - determines or indicates the kind of instructional strategies that might be more effective.

In the content of the study - which was an introductory definition of learning difficulties - emphasis was placed on differentiating the basic concepts from similar ones. When the concepts were more related to abstract ideas, the strategies tended to be more verbal than those for "concrete" concepts. They consisted in:

- presenting and having the student analyze verbal definitions in their component parts
- examining verbal examples and counterexamples in their component elements
- placing the concept in different contexts in which they could or could not be used
- making "maps" or schemata or classification tables in order to summarize in a more visual and concrete manner

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1) Apparently, R. Schuemer uses the term 'operational definition' in a more restricted way.

Furthermore, since it is widely admitted (and my own teaching experience reaffirms this) that, in general, Venezuelan students are quite passive in their learning, weak in language areas and unaware of their learning processes, the instructional material aimed at developing "metacognitive" strategies in the student asking him to carry out the tasks by himself, to compare his answer with other possible ones given in the text, to apply it to other situations and to summarize the procedure employed to solve the problem. So, the instructional purpose actually was not only to have the student recognize the concept and its limits but also the strategies used to grasp it. And, as can be seen, the strategies are very much oriented toward "reading techniques".

When the concepts were more concrete, such as defining a writing difficulty, in addition to all or some of the means above described, more concrete means were used as illustrations (a page written by a l.d. child) as an example or an exercise for analysis. In the case of reading difficulties, articulation and rythm difficulties were reproduced in a written manner (in the real material, an audiocassette is also available and several exercises are based upon it). In my opinion, a cassette or any written didactical means can better be used if the kind of content is taken into account.

Probably, page 73 of the conclusiosn leads one to believe that I generalize upon the virtues of instructional treatments. I think that a phrase - that I recently wrote in a Spanish résumé of the thesis - should be added before the ending of the paragraph: "There is probably a direct relationship between the kind of content and the text presentation; this relationship should be studied."

- **Didactical treatment/alterations of contents:** This is a question I also asked myself. In order to avoid dissimilarity, a chart was made indicating each content item of version 1; then, each item was looked for in the original sources; at the same time an attempt was made to match the preciseness and the depth of the treatment of the information. Therefore, no content item of version 1 is absent in versions 2 and 3.

An effort was made (in version 1) to say the same thing the original author was saying (X is so and so), but in a different manner. For example, when defining an idea, the definitions of several authors were reproduced. Each one was anlyzed and then compared in its component elements and

significance and then compared with the others; this led to categorizing the definitions.[1] In Version 3 - "eliminated" - the same authors were taken, but in their integral text. Students were absolutely free to isolate the definitions, to analyze and to compare them, if they wished to. So, an important task for them should have been to realize that concepts they were reading about should have been clear to them. In version 2, by means of the Study Guide, students were invited to carry out the same operations as students in version 1.

Therefore, I agree that there is a change in stresses, redundancy and structure of the content under study and also in the language, which tried to be simpler. Relationships that were not mentioned or stressed in the Selected Readings were established in versions 1 and 2 by means of exercises and text organization. But I am not sure that the content was different; our aim was to help students to understand the meaning of what each author was saying.

In order to give an idea of how the content was reorganized in version 1, here the index of version 1 and of the Selected Readings. Let us compare them:

Version 1	Selected Readings
- Presentation	- Idem
- General Introduction (it was a general schema - an "advanced organizer" - integrating Texts 1 and 4)	- Missing
- Unit 1	
- pp. 9-24	- Corresponded to Texts 1 and 3
- pp. 25-33	- " " Text 2
- pp. 34-37	- " " Text 4
- Objectives	- Missing
- Self-evaluation	- Missing
- Additional comments	- Corresponded to Texts 5 and 6

1) Kinds of definitions: This was not a really new content item since the Selected Reading had a text identifying categories of 1.d and giving one or two examples. The differences were that the analysis was missing, the examples were fewer and the explanations about them less detailed.

- **Use of another text for versions 2 and 3:** I agree that in spite of all the cares taken, it cannot be excluded that the versions differed in content.

The reason why different texts were used is not explained in the report. Indeed, it was because, at that time, a discussion was going on in our university. Some argued that it was not necessary for distance education to prepare its own material since the original sources plus a study guide (not as analytic as the one used in the study) could be enough. I believed, and I still do, that special text elaboration is needed when a combination of the following conditions is prestent:

- original sources are at variance with one another (no integration of trends can be found in the literature about the subject matter)
- the language of the original source is too sophisticated and technical
- the subject matter is taught at the lower levels of a cereer
- students have weak study habits and reading techniques, and live in poor socio-cultural environments, as is the case in Latinamerican provinces.

The unit under study was elaborated to create a cognitive structure in which to anchor the content that would follow in the next units. And the whole course also had this purpose: to construct a network of basic contents to which the next courses - less directive than those within the curriculum - could refer to.

(3)

(a) **Design:** I thank you for your suggestion for a better design. I should have made it clear that the intention was also to avoid that group 3 should get information about our objectives.

With regard to the dimension of the sample, this was a problem easy to predict but difficult to avoid. Drop out was a predictable problem, but to avoid it would have demanded some kind of support from the University as an institution: for example, to offer the different versions of the unit as regular units (so that it would have been obligatory for everyone) or to give some compensation for the cooperation (credits, or instructional material), but both kinds of support were impossible to obtain in a short span of time.

(b) **Operational definitions of the dependent variables:**

- **Definition of the posttest scores:** The scores differed according to the complexity of the required answer:

  - Level A and B: number of correct answers.
  - Level C: half of the scores were given to the number of correct details mentioned and half of the scores were given to the quality of the integration.

- **Definition of the three levels of processing:** In effect, definitions on pp. 8-9 are not operational enough. The criterion used to finally classify an item at each level was:

  (1) Given several options, the student had to select which one was the best
  - to identify a concept, a fact or a principle: Level A.
  - to translate a piece of information from one language into another: Level B.
  - to argue a point of view basing the choice upon the theoretical content given in the unit: Level B.

  (2) Given a question, the student had to write a personal synthesis about the subject matter asked, demonstrating a coherent integration of ideas and a correct use of concepts.

  I think you are right about the three dependent variables.

(c) Effectively, unequal cell frequency did occur. Data about the distribution are available.